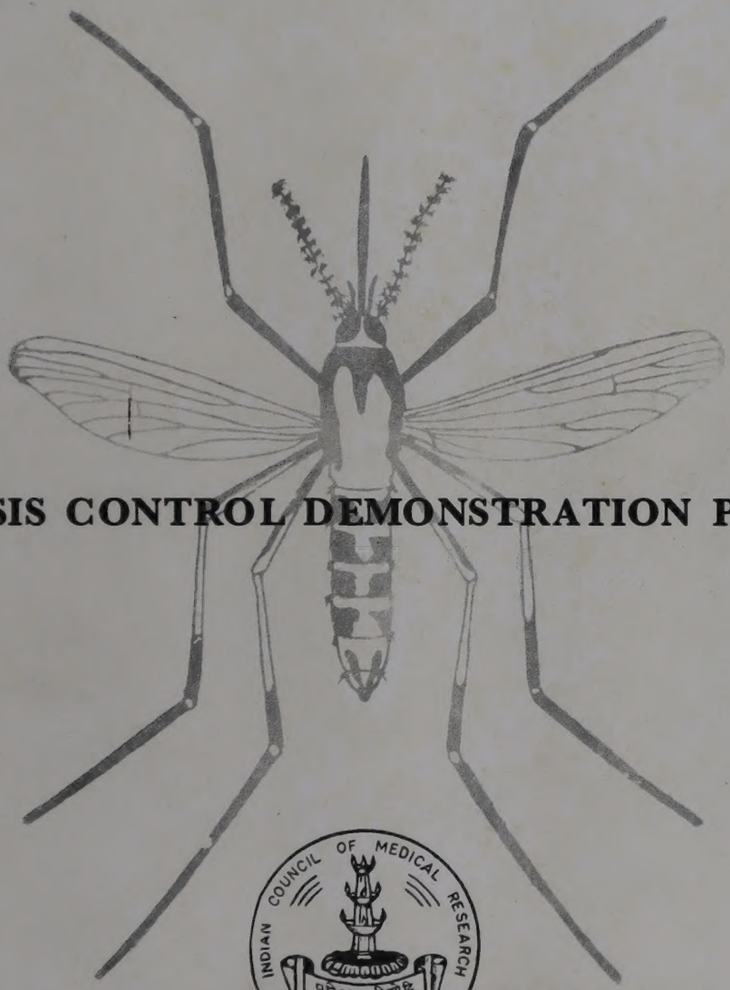
ANNUAL REPORT

1981



FILARIASIS CONTROL DEMONSTRATION PROJECT

VECTOR CONTROL RESEARCH CENTRE

PONDICHERRY

INDIA

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A Research-cum-Action Oriented

PROJECT

ON

"DEMONSTRATION OF CONTROL OF BANCROFTIAN FILARIASIS IN PONDICHERRY URBAN AGGLOMERATION BY CONTROLLING THE VECTOR *Culex quinquefasciatus*"

(1981 - 1985)

A collaborative venture between

THE DIRECTORATE OF HEALTH SERVICES,
GOVT. OF PONDICHERRY

AND

VECTOR CONTROL RESEARCH CENTRE

(INDIAN COUNCIL OF MEDICAL RESEARCH)

PONDICHERRY

PREFACE

The 'Filariasis Control Demonstration Project', a joint venture undertaken by the Vector Control Research Centre and the Directorate of Health & Family Welfare Services, Govt. of Pondicherry, is now in its second year of operation. Since the main emphasis is on environmental manipulation and source reduction, the progress is naturally slow to moderate. But, if this moderate progress is a continuous one and the tempo is kept up, the objectives would be achieved. Ultimately, both the Government of Pondicherry and the people will have to ensure that the gains achieved are not lost at the end of the five year period when the ICMR project will be terminated. It is with this intention that the project committees specially formed for its implementation are insisting on a multidepartmental approach. In the following pages the various measures taken so far and the gains achieved (and the drawbacks too) are detailed, along with the revised protocol.

The project is the first of its kind in India since it is goal oriented and time bound. The messages from the Prime Minister and the Union Minister of Health, given at the time of inauguration of the project, are deliberately printed again to emphasize the importance and national relevance of this project. Prof. V. Ramalingaswamy, Director General of Indian Council of Medical Research, is keen that all research findings must have practical applications and must be utilized to alleviate human suffering. This is the forerunner of several such extension projects undertaken for the control of communicable diseases all over India by the Council's Research Centres.

We are happy to record that the new Lt. Governor of Pondicherry, His Excellency R. N. Haldipur, has taken a personal interest in removing bottlenecks in the implementation of this project. We sincerely hope that the different departments responsible for improvement of Pondicherry will wholeheartedly cooperate in the implementation of this project.

P. K Rajagopalan
Project Director

15-2-1982

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Smt. INDIRA GANDHI
Prime Minister

सत्यमेव जयते

New Delhi
7 January, 1981.

MESSAGE

Filariasis, like malaria, is intimately related to environmental conditions. Filariasis causes varying degrees of discomfort, debilitation and deformity.

I am told that more than 236 million people in India are exposed to the risk of filariasis infection and that 18 million actually carry filariasis organisms in their bloodstreams. The progress in controlling the disease has been slow. We have decided to intensify these efforts.

I am glad that the Indian Council of Medical Research and the Government of Pondicherry have joined to develop an integrated strategy for mosquito control in Pondicherry. Studies have shown that in January 9 million mosquitoes emerge every day in Pondicherry alone. The number can be reduced only by improving and eliminating the drains, cesspools and pits where mosquitoes breed. This needs the active involvement of all people who must be encouraged to take keen interest in environmental cleanliness in every street and locality.

My good wishes for the Pondicherry project.

INDIRA GANDHI

B. SHANKARANAND
Union Minister for
Health & Family Welfare
Government of India

सत्यमेव जयते

New Delhi
7 January, 1981.

MESSAGE

I am very glad that the Indian Council of Medical Research and the Government of Pondicherry have jointly taken up a research-cum-action oriented project for the control of filariasis in Pondicherry through integrated measures for the control of mosquitoes. The problem of filariasis is a vast one in our country, approximately 236 million people are exposed to the risk of infection. The National Filariasis Control Programme is engaged in the task of controlling filariasis on a nationwide basis. It is obvious, however, that we must make more rapid progress and new approaches, carefully tried out and evaluated are urgently needed.

The Vector Control Research Centre of the Indian Council of Medical Research, has collected over the past few years valuable data on the habitat and behaviour of the vectors that transmit filariasis in Pondicherry. This should enable a control programme to be mounted based upon scientific evidence. It is a happy augury that a research institution and local authorities have joined hands in designing the project and implement it. The whole country awaits the outcome of this study so that the experiences and lessons learnt from the study may be utilised in setting up more effective and more permanent solutions to the problem of filariasis. Indeed, I believe that the study is the beginning of similar activities to be initiated by the ICMR for the control of diseases transmitted by insects. I wish the project all success.

B. SHANKARANAND

R. N. HALDIPUR
Lieutenant Governor

RAJ NIVAS
Pondicherry-605001

MESSAGE

I am happy to learn that the First Year's Progress Report on 'Filariasis Control Demonstration Project' is to be brought out shortly by the Vector Control Research Centre at Pondicherry.

This centre has undertaken a multipronged drive to fight the diseases caused by the vector carried by mosquitoes. Various Departments of the Government have to play a committed role in this task to achieve tangible results.

I am sure the non-official agencies in Pondicherry will also lend a helping hand in propagating the message of cleanliness and environmental sanitation amongst the people through a mass education programme.

I wish the endeavours of Vector Control Research Centre all success.

R. N. HALDIPUR

Prof. V. RAMALINGASWAMI
M.D., D.Sc. (Oxon), F.R.C.P. (Lond),
F.R.C. Path. (Lond)
Director General
Indian Council of Medical Research
NEW DELHI

MESSAGE

We are at cross roads with regard to control of disease carrying mosquitoes and of mosquito nuisance. Whatever may be the reasons, we have failed to consolidate our glittering successes in the early stages of the malaria eradication campaign using DDT as a residual indoor spray. Malaria, Filariasis, Kala-Azar and Japanese Encephalitis, all transmitted by insect vectors are daunting us and we are not fighting a particularly successful battle against them. The reasons are a mixture of vector resistance to insecticides, technological inadequacy, knowledge gaps in epidemiology and vector biology and inefficient administrative and managerial strategies.

At this hinge of the history in the control of insect-borne diseases, new strategies putting the known-knowledge and technologies to more effective action are required. The integrated vector control project in the town of Pondicherry is a response to this challenge made by the ICMR's Vector Control Research Centre working in close collaboration with the Government of Pondicherry. Such a project can only succeed if there is an active involvement of the people. It is a fore-runner of a wider application of this approach to the rest of the country. We cannot afford not to succeed.

V. RAMALINGASWAMI

PART I

REVISED PROTOCOL

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1. TITLE OF THE PROJECT

DEMONSTRATION OF CONTROL OF BANCROFTIAN FILARIASIS IN PONDICHERRY URBAN AGGLOMERATION BY CONTROLLING THE PRINCIPAL VECTOR *CULEX QUINQUEFASCIATUS*.

2. OBJECTIVES

2. 1. Development of appropriate methodology for vector control in a large town using integrated pest control technology.

2. 2. Drastic reduction of microfilaria rate in the population of age group 0-5 years at the end of the project period by interrupting transmission.

2. 3. Reduction in vector density and man-vector contact.

2. 4. Study of cost-benefit analysis.

3. DURATION AND FINANCING AUTHORITY OF THE PROJECT

3. 1.	Preparation time	—	6 Months (July 1980 - December 1980)
3. 2.	Operational phase	—	5 years (January 1981 - December 1985)
3. 3.	Analysis of data and preparation of final report	—	6 Months (January 1986 - June 1986)
3. 4.	Financing authority	—	Indian Council of Medical Research

4. INVESTIGATING AUTHORITIES

4. 1. Principal Investigator : Director,
Vector Control Research Centre,
Pondicherry.

4. 2. Co-Investigator : Director of Health & Family Welfare Services,
Government of Pondicherry,
Pondicherry.

5. INTRODUCTION

There are several reports which highlight the problem of filariasis in India. The population exposed to risk as assessed in different years is given below :

1953 — 25 million[1]
1958 — 64 million[2]
1968 — 136 million[3]
1976 — 236 million[4]

It was estimated that the number of microfilaria carriers is 18.3 million and the number of diseased persons is 14.4 million[4]. The percentage of microfilaria carriers in the population living in endemic areas is 7.8, with 6.1 percent having disease manifestation. It has been repeatedly stated that "though filariasis is a major public health problem the disease does not seem to have evoked much enthusiasm in the minds of Indian Medical Scientists"[3]. Since filariasis is a non-fatal disease, it has received less priority in many countries where other tropical diseases of more importance prevail. In South East Asia, along with the control and eradication of many of the parasitic diseases, there is an urgent need to control filariasis. According to present knowledge it may take us another half a century or more before the parasite can be eliminated from our population. In fact, in some areas of the world the filariasis problem is increasing due to urbanization. A final factor, which has in the past been largely neglected by many scientific research workers and epidemiologists in the control of filarial and other parasitic infection and in the spread of communicable diseases is the role of human behaviour. According to Prof. Dunn, filariasis related to human behavioural research is a fundamental requirement together with continuing research on vectors and parasites for improvement in the present *unsatisfactory* state of filariasis control in most if not all endemic areas.

6. FILARIASIS IN PONDICHERRY

6.1. Filariasis in Pondicherry as projected by State N. F. C. P.

The first ever filaria survey was carried out in Pondicherry region in the year 1957 by a team deputed from the Filariasis Training Centre, Ernakulam, now shifted to Calicut. The results obtained are given below[8].

Population	—	2,58,561
Mf. rate in town	—	10.3%
Infection rate	—	3.1%
Infectivity rate	—	1.4%
Disease rate	—	2.7%

After the initial survey regular yearly surveys were carried out by N. F. C. P. The data are shown below.

Year	No. cases examined	No. +ve	mf. rate	Disease rate	Endemicity rate (mf. rate + disease rate)	10 man hour density	Infection rate	Infectivity rate
1961	—	—	—	—	—	297.53	9.22	0.89
1962	83	11	13.25	Nil	13.25	177.94	5.96	0.37
1963	655	61	9.31	Nil	9.31	72.43	4.46	Nil
1964	5610	437	7.78	Nil	7.78	65.48	2.22	Nil
1965	11178	846	7.57	Nil	7.57	67.25	3.09	Nil
1966	10829	727	6.71	Nil	6.71	66.95	3.43	Nil
1967	8619	481	5.58	Nil	5.58	70.80	3.31	Nil
1968	8926	511	5.73	Nil	5.73	62.24	2.55	Nil
1969	9045	370	4.09	Nil	4.09	61.92	2.97	Nil
1970	10429	674	6.46	Nil	6.46	51.40	2.30	Nil
1971	11453	267	2.33	Nil	2.33	58.78	2.46	Nil
1972	12456	855	6.87	Nil	6.87	60.59	1.55	Nil
1973	13212	818	6.19	0.86	9.05	44.54	3.42	Nil
1974	—	—	—	—	—	41.08	2.95	Nil
1975	—	—	—	—	—	48.59	0.05	Nil
1976	—	—	—	—	—	37.80	0.06	Nil
1977	5989	467	7.79	1.26	9.05	36.00	Nil	Nil
1978	2850	154	5.40	0.11	5.51	34.40	Nil	Nil
1979	15967	1408	8.82	0.57	9.39	26.80	Nil	Nil
1980	24022	1174	4.89	0.62	5.51	53.97	1.20	0.24

6. 2. Control measures

Anti-larval measures which were confined to Pondicherry town and in certain parts of the adjoining communes of Mudaliarpet and Oulgaret are now extended to the rural areas also of Pondicherry region. The population covered is approx. 3,00,931. There is no change in the other activities.

Anti-larval measures are supposed to include minor engineering works, in addition to spraying of ML oil at the rate of 25 to 28 ml. per Sq. meter. Once a week, pyrosene oil has also been used wherever necessary. Recently, temephos 50% EC is also being used.

6. 3. Problems in implementing N.F.C.P. in Pondicherry

Many bottlenecks are stated to be experienced by the N. F. C. P. regarding anti-larval operations. These are : "(i) In the cross streets pucca drains are covered with R. C. slabs under which there are polluted water collection where mosquito breeding cannot be controlled., (ii) There are two big canals running to the sea, carrying the sewage water of the town and also the effluents of the weaving mills. The exit of these canals is often blocked at their end near the estuary which favours the breeding of mosquitoes, (iii) Many cattle sheds exist in the town where the residents refuse to spray the ML oil and (iv) There are enclaves of the neighbouring state of Tamil Nadu where no control of filariasis is implemented and the disease is likeiy to spread from uncontrolled to controlled areas."

7. ASSESSING INFECTION

Prevalence of filariasis in a population is generally measured on the basis of the presence of microfilariae. Numerous methods have been employed in the past for the determination of microfilaria rate and densities. Many of these techniques have been used in epidemiological studies for assessing prevalence rates of filariasis in various parts of South-East Asia. However, because of the wide variation in volume of blood examined and in methods of examination, it is often difficult to compare the results obtained. The insensitivity of the test in which 20 or 60 c.mm of peripheral blood are taken from a subject, has often lead to an underestimation of true prevalence, especially when microfilaria densities are low in a population[5]. Usually if a person has microfilariae in a sample of blood, he is considered 'positive', if no microfilariae are found, the individual is considered 'negative'.. It has been well established from the many earlier studies that the chances of detecting microfilariae in a person increase proportionately with the amount of blood examined. More recently, methods of concentrating microfilariae through membrane filtration techniques as well as counting chamber techniques have been devised and it has been shown by comparative studies that the chances of detecting microfilariae increase three to five times by concentration methods as against a normal 60 c.mm. blood film. This clearly proves that in the past all epidemiological studies based on finger prick blood has to a great extent underestimated the prevalence of filariasis in a population. It would indeed be difficult to use concentration techniques extensively in the field to assess microfilaria rates and densities in a population. However, it is vital that an accurate estimate be obtained. Perhaps, it would be possible to work out a "Correction factor" based on the above studies, which could be used to achieve accurate epidemiological assessment of microfilaria rates in a population initially surveyed by means of finger prick blood examination. This clearly indicates that large proportion of the population, although positive for microfilariae, was left untreated because of the lack of sensitivity of the test used.

Besides this major disparity, there are other factors which come into play in assessing prevalence, such as the nature of periodicity of the microfilaria, the time the blood is taken and examined in a survey, the method of examination, as well as other variables. Various studies carried out in the population have shown the importance and the need for better method of evaluation.

8. THE PROBLEM IN PONDICHERRY

An indepth study was carried out by the

Vector Control Research Centre, one of the institutions under the Indian Council of Medical Research (Ministry of Health, Government of India), on all aspects of filariasis[6, 7]. The highlights are given below.

Pondicherry is highly endemic for filariasis. The endemicity rate is about 20 percent, i.e. one out of every five person is either a microfilaria carrier or a chronic patient (Elephantiasis etc.). It must be mentioned that Pondicherry is not the only place where such a high endemicity level exists. There are many other towns where the problem is similar or more severe, but there are no data available. This endemicity is maintained by a very high mosquito density. An extensive study by the VCRC has shown that the *number of mosquitoes emerging per day* from different habitats range from 6,00,000 in November to 9 million in January. The major habitats contributing to the mosquito production are the drains and cess pits (Fig. 1). It has also been found that high densities of the mosquito population are required to maintain a high level of transmission as found in Pondicherry.

9. STRATEGY-CHEMOTHERAPY OR VECTOR CONTROL?

9. 1. Chemotherapy

The only available chemotherapeutic measure for filariasis control is the administration of DEC. Though DEC is supposed to clear mf. from the blood when the full regimen is administered to the individual, it is well known that due to some obscure reason some mf do persist in circulation inspite of heavy doses of DEC[9, 11, 12, 13]. Though many claims were made that DEC sterilizes or kills the adult worm[14, 15] its action on the adultworm is doubtful[16]. The efficacy of mass administration of DEC to reduce transmission in a community has also not been demonstrated conclusively[17 - 30]. Three types of trials have so far been undertaken, namely,

i) Mass administration of drug

ii) Selective administration of drug to the mf. carrier and

iii) Mass administration through medicated salt.

Medication through food medium was tried in the past mainly in the form of medicated salt. Several trials undertaken all over the world[17-30] showed that the medicated salt regimen in small isolated communities may yield encouraging results, whereas in bigger communities it would not be able to control filariasis due to following reasons.

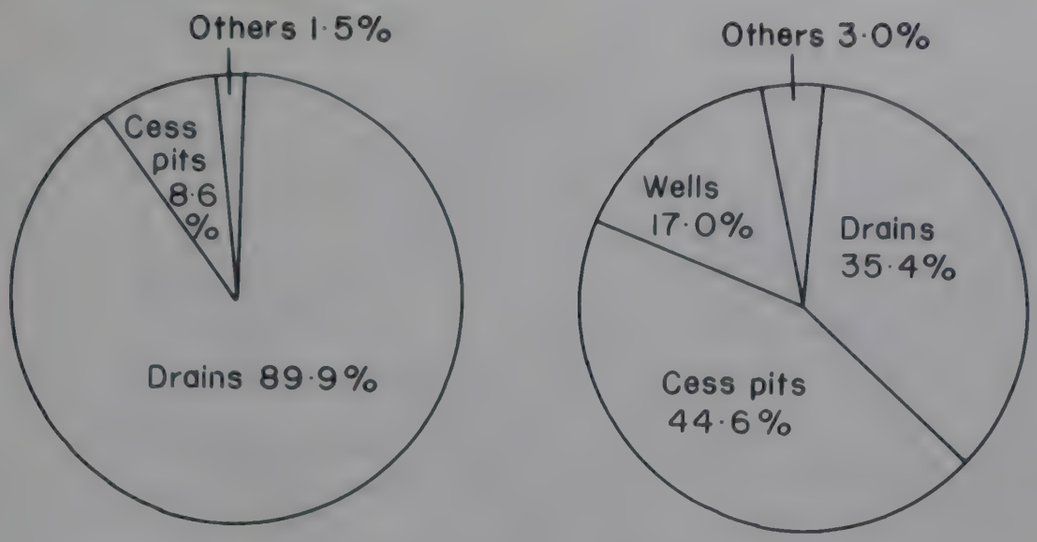
9. 1. 1. *Toxicity of the drug :*

In some earlier trials it has been shown that mass administration of drug is not feasible because of severe toxicity to drug and the reluctance and refusal of the community to continue the treatment for prolonged period[17-21]. Based on these results, the ICMR Assessment Committee[2] recommended to discontinue the mass drug therapy as a measure of control of filariasis.

9. 1. 2. *Incomplete clearance of mf.:*

Earlier trials had shown that even when drug consumption level is high, mf. remain in the blood in lower density in many cases. In one study when mosquitoes were fed on carrier with low mf. density about (57-67%) failed to pick up microfilaria. But those that did pick-up invariably ingested more microfilaria than expected. This is probably due to homogenous distribution in low mf density in contrast to presence of mf in clusters[33]. It is well known that a negative correlation exists between the number of mf. ingested and infective stage produced[34,35] and longevity of the mosquitoes. Therefore, even though infection rate may be lowered, the high number of infective stage larvae will compensate for the loss and in the presence of vectors in high density it will again come back to normal level[42]. It was demonstrated that there is a direct proportionality between the number of infective stage larvae injected and number of adult developed[43]. In such circumstances prevalence of mf at lower density may increase the transmission potential when vector density is very high.

Fig. 1



POST MONSOON
(January)
High density season

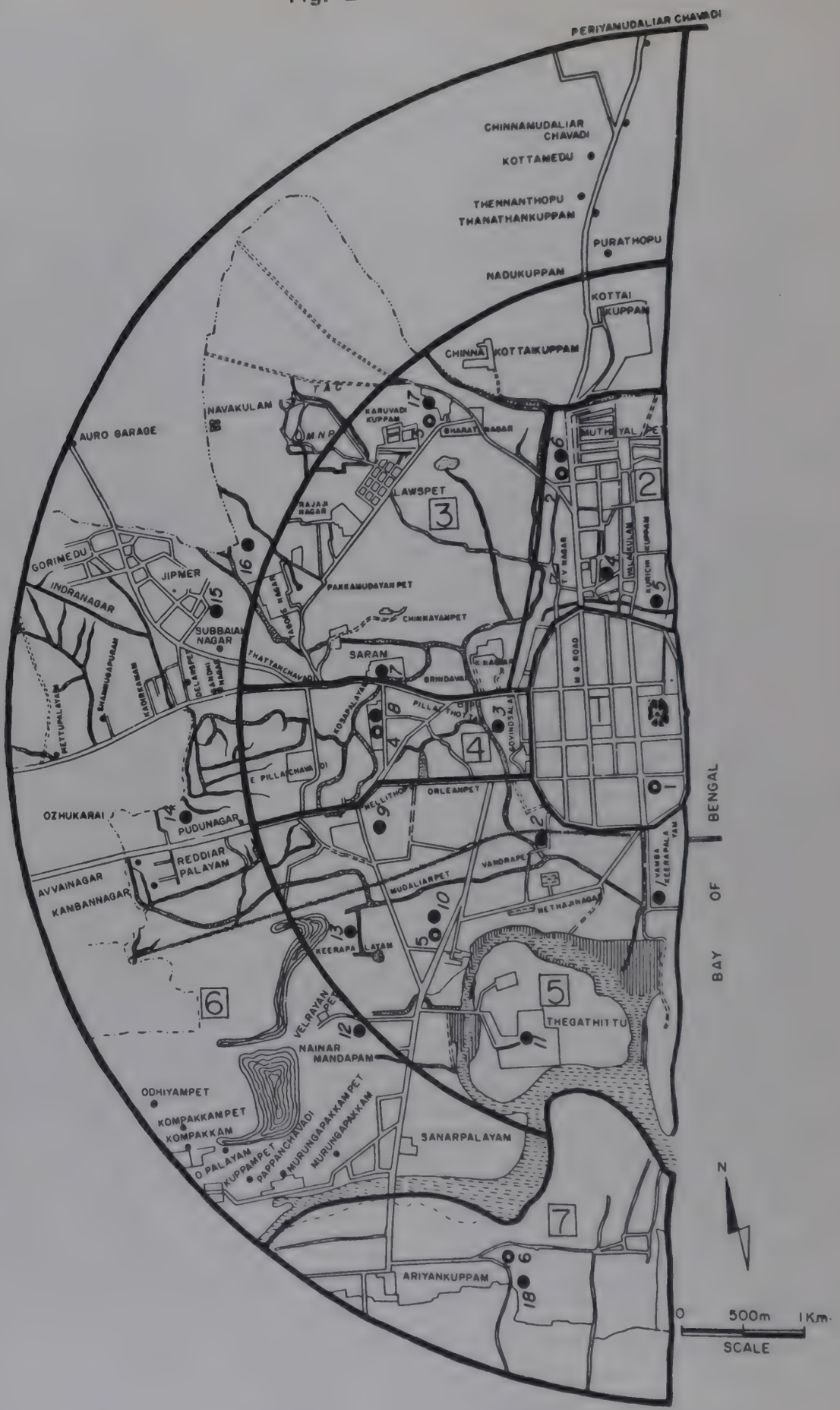
MONSOON
(November)
Low density season

Relative contribution of different breeding habitats to the total daily emergence of *C.p.fatigans*.

Months	Rainfall(*mm*)	Estimated number emerging per day
1977 Dec	27·6	369,900
1978 Jan	3·6	9,612,800
Feb	0	874,800
Mar	0	873,900
Apr	0·1	1,412,500
May	4·3	854,800
Jun	23·2	739,300
Jul	101·0	262,200
Aug	73·2	606,200
Sep	306·7	411,900
Oct	272·2	284,000
Nov	564·9	172,900

Estimated number of *C.p.fatigans* emerging daily from all habitats in Pondicherry town (10 Sq.Kms.)

Fig. 2



Complete study area

9 1. 3. Provocative action of DEC :

DEC is known to disrupt the periodicity in periodic microfilariae and induce diurnal appearance in nocturnally periodic microfilariae in peripheral circulation[44-48] and thereby increase the infection rate because mf is present for a longer time in the peripheral circulation.

9. 1. 4.

It has got no action on infective larvae[49] (L_3). Therefore it has no prophylactic action also[23-50].

It is therefore clear that DEC medicated salt programme is only curative rather than preventive. The mass administration of a drug to an entire population when the prevalence is less than 20% also calls for ethical considertions.

9. 1. 5.

In an island situation, people learned to make their own salt. They washed the salt to remove the drug. In some trials it was fed to cattle and many such misuses were observed. In a open community it remains to be seen how such loopholes will be prevented. Under these circumstances DEC medicated salt in a large scale control programme plays only a limited role.

9. 2. Vector control

Under these circumstances, control of vector offers the only permanent solution for the control of filariasis transmission. Though the principal vector, *Culex quinquefasciatus* has very high reproductive potential and is a ubiquitous breeder, epidemiological studies have shown that a patent case of filariasis is the result of very large numbers of repeated infective bites[6, 51]. It would therefore appear that it is not necessary to eradicate the vector species but would only be necessary to reduce its density to a moderate to low level. It was estimated that a per man hour density of 3.4 is safe[52]. This hypothesis however need to be tested, and the present project will evaluate this aspect also. Secondly all aspects of both larval and adult ecology have been intensively studied in Pondicherry[7], with the major breeding areas demarcated. By controlling breeding in the major habitats, which vary with seasons and for which data are available, it would be possible to reduce filaria transmission to a negligible level.

10. STUDY AREA

10. 1.

Pondicherry town and its urban agglomeration form the study area, which also includes many villages of Pondicherry as well as enclaves of Tamil Nadu, as they form one compact semicircular area (Fig. 2). The total area is 59.38 Sq. kms covering a population of 2,72,000 (1981 census). The area is demarcated by the Bay of Bengal in the east, and boundary arc passes from Veerampatinam, a coastal village in the south, along Ariankuppam, Pappanchavadi, Kompakkam, Kundupet, Gorimedu, Aurogarage (Moratandi) and joins Periamudaliarchavadi in the north. All localities within this arc, form the study area.

For operational convenience, the study area is divided into seven zones, as detailed in page 6 (Fig. 3 to 9).

10. 2. Soil type

There are three types of soils: red ferralitic black clayey and coastal alluvium. Red ferralitic type are prevalent mostly in the elevated northern part of the study area, and coastal alluvium on the eastern border and the remaining area constitutes the black clayey soil. Except the black clayey soil others are highly porous and does not retain water.

10. 3. Rainfall

Eventhough this area receives an average

Zone	Population*	Houses	Area in sq. km.
1	58,426	4,513	2.80
2	39,956	5,062	3.10
3	35,060	4,849	10.20
4	23,151	2,947	2.40
5	56,523	5,720	11.42
6	48,856	3,422	24.02
7	10,278	1,059	5.44
TOTAL	2,72,310	27,572	59.38

*1981 census

rainfall of 1254 mm/year there are two well marked seasons :

1. South-West monsoon season — June-September
2. North-East monsoon season — October-December

The North-East monsoon accounts for 500 to 1000 mm of rainfall and the rest is scattered during the remaining period. Month-wise average rainfall for last twenty years were plotted in Fig. 10.

10. 4. Climate

The climate of this area is characterised by humid summer, rainy days and a relatively cool season. The average maximum and minimum temperature and relative humidity for the last twenty years are given below.

Avg. max. temperature	*Avg. min. temperature*	*Relative humidity* (%)	
37.03	20.00	81.96 (7.00 hrs)	80.62 (21.30hrs)

The hot summer starts during the month of March and reahces the peak in May touching a temperature between 39-41°C and thereafter recedes in July. The cool season starts in December and extends upto February.

10. 5. Water supply

Protected water supply has been provided to almost all the area within the study area by three overhead tanks. The Muthirapalayam over head tank accounts for nearly fifty per cent of the water need and the remaining area is being covered by another two overhead tanks. As the underground water table is also very high there are many hand pumps and open wells which are used for drinking purposes. As far as water supply is concerned, the study area is affluent and this has also led to severe mosquitogenic conditions, because of unjudicious use of water by the people.

10. 6. Aspects of human behaviour resulting in mosquitogenic conditions

10. 6. 1.

As has already been stated, the present urban agglomeration of Pondicherry has

Fig. 3

Control Zone - 1

Fig. 4

Control Zone - 2

Fig. 5

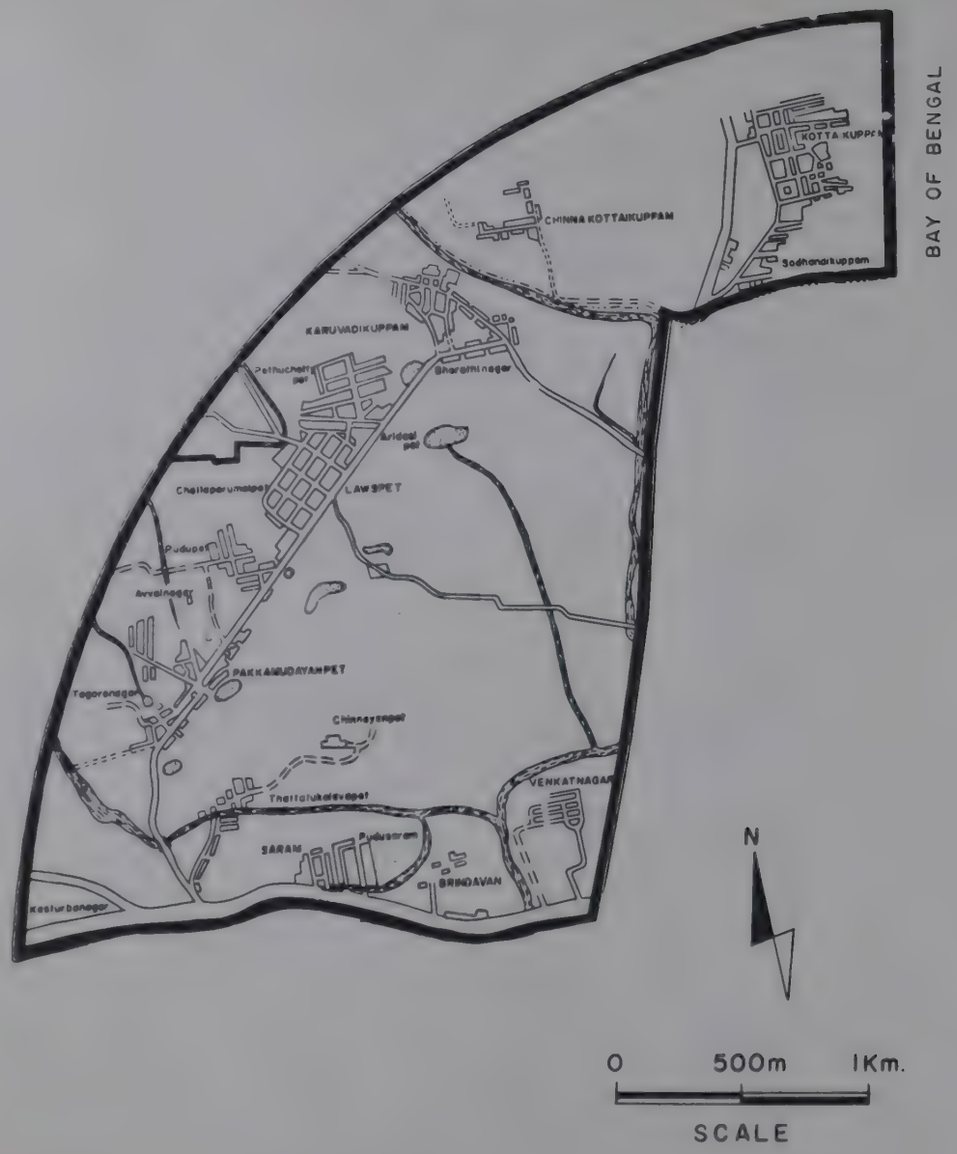
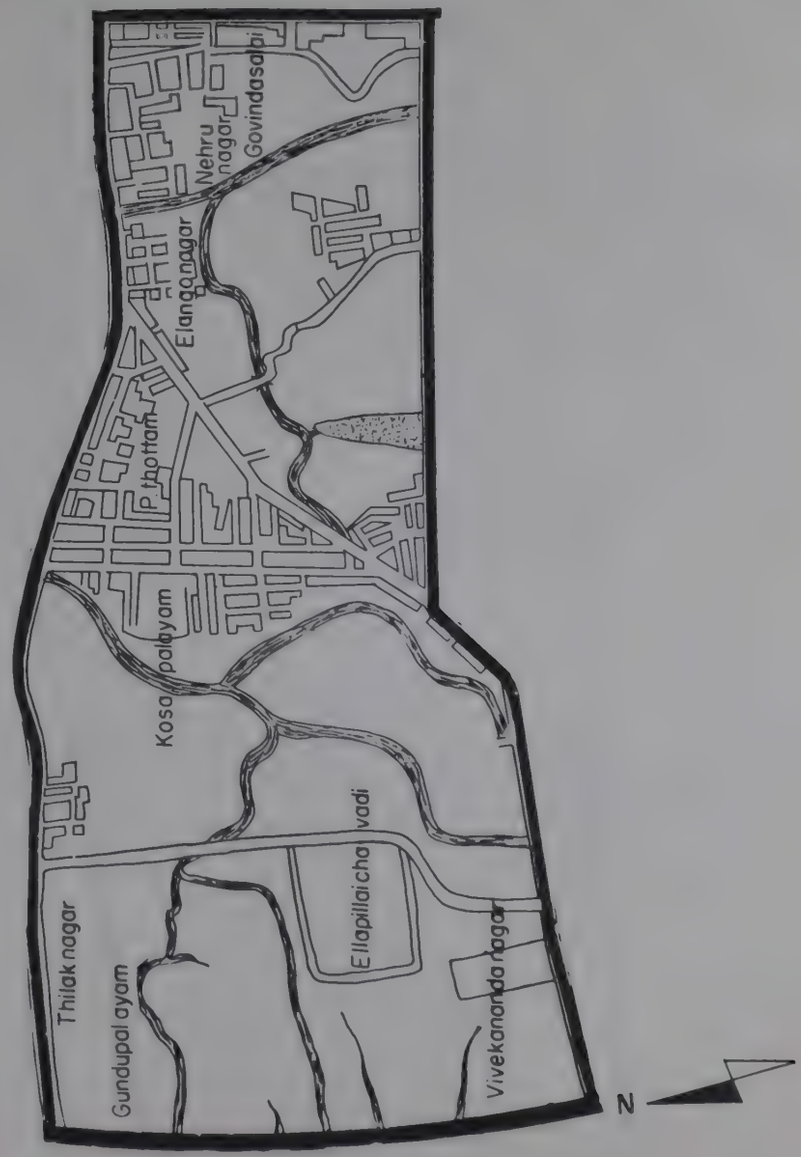


Fig. 6



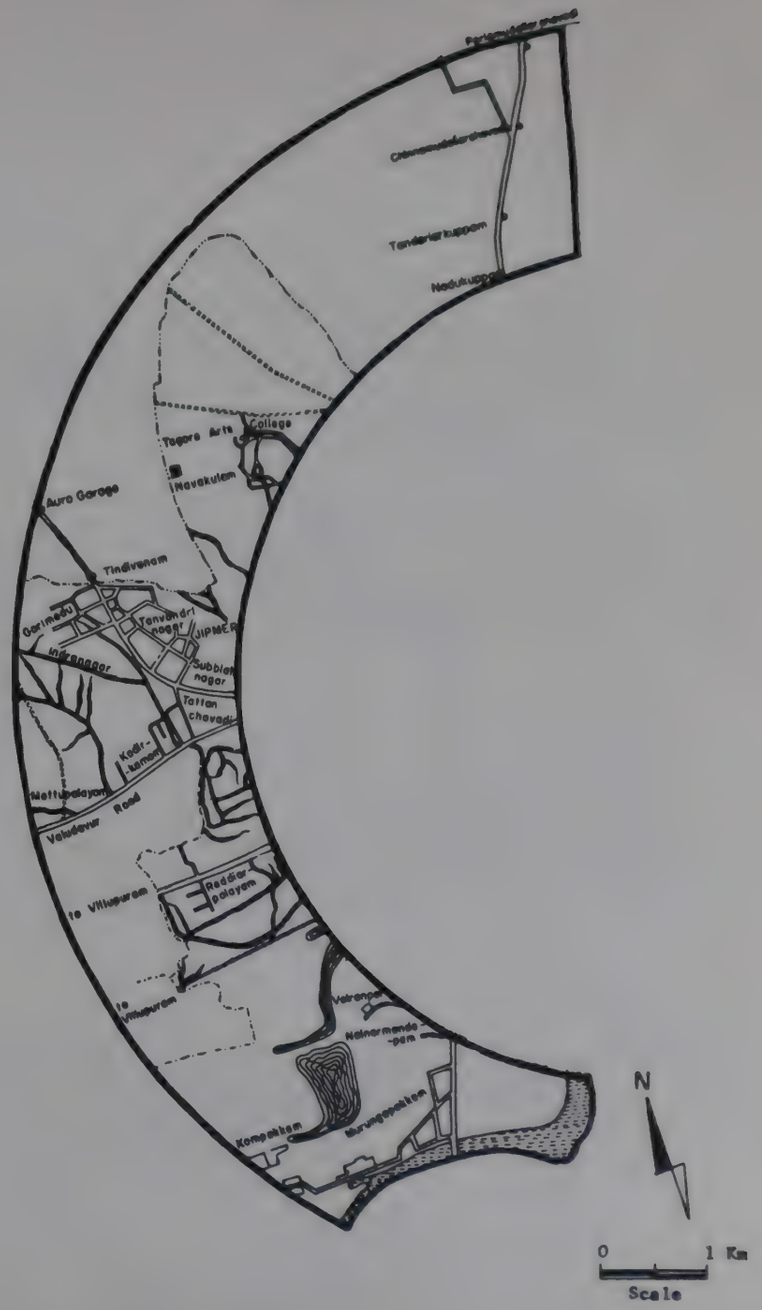
Control Zone - 3

Control Zone - 4

Fig. 7

Control Zone - 5

Fig. 8

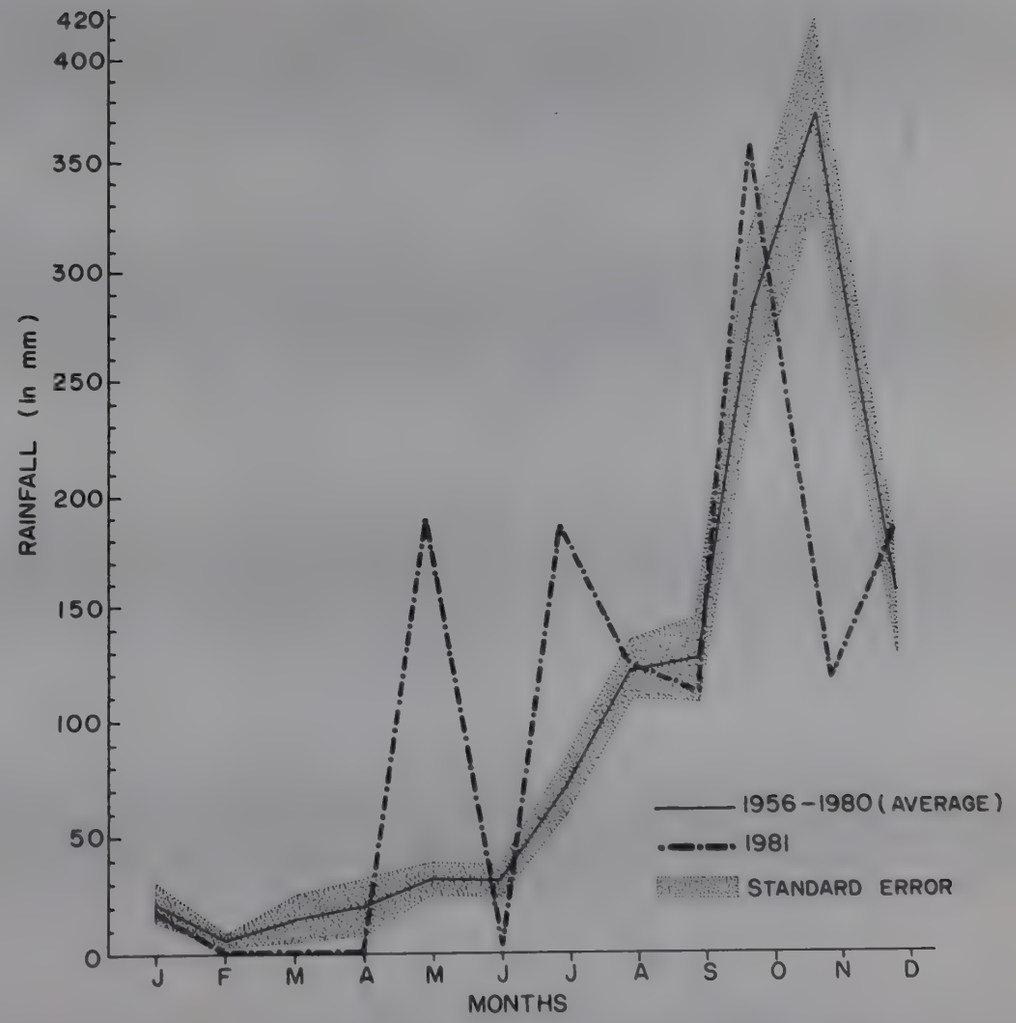


Control Zone - 6

Fig. 9

Control Zone - 7

Fig. 10



Average rainfall in the study area

come up in what was hitherto agricultural lands. Because the main source of water for irrigation comes from tube wells, one can always see the major crop (paddy) in different stages of cultivation at a given time. There are other crops like pulses, millets, etc. which are grown on the outskirts. The area is also interspersed with numerous coconut and banana plantations. Because of these, there are many man biting mosquitoes breeding in moderate to high densities though they may not necessarily be vectors of bancroftian filariasis.

10. 6. 2.

There are many small and medium industries which attract a big labour force; notable examples are the several textile mills. The effluents from these are discharged without any arrangements for their proper disposal and as a result contribute to the mosquitogenic conditions. Numerous slum colonies have sprung up around the textile mills where, because they have come up in low lying agricultural lands, water accumulates and stagnates creating large cess pools breeding mosquitoes.

10. 6. 3.

Coir making is one of the cottage industries which accounts for major mosquitogenic conditions. For making coir coconut husk is submerged in water in pits (2 metres diameter and 1 metre depth) for a period of 3 to 6 months and after that it is beaten up to extract the fibre. This is a common scene in most of the low-lying area near the beach or the back water rivers. These coir pits were found to be a very good habitat for the breeding of mosquitoes and the total surface area of such coir pits will be about two hectares in the urban area heavily breeding mosquitoes (Fig. 11).

10. 6. 4.

Being a place of tourist attraction, there are innumerable shops and eating establishments which also aggravate the mosquito problem. Licences are issued to open these without ensuring proper waste water disposal. All effluent water is let into the open. Solid garbage is dumped in nearby canal blocking the flow of water.

10. 6. 5.

In general there are only two classes of people i.e. rich and poor. The richer class, whose income is far above that of the other residents and disproportionate to their education status, rarely respond to any measures for civic improvement and the other section is reluctant because they cannot afford it.

10. 6. 6.

During the last two decades the population in the study area has grown enormously. The urban population has increased from 50,000 in 1961 to 2,72,000 in 1981. The growth rate of population and the urban area expansion during the past decades are shown in the following table:

Year	Total Population	Urban Popluation	% of urban/total	Urban area Sq. km.
1961	1,40,164	51,762	36.93	3.98
1971	1,92,007	1,54,945	80.70	29.51
1981	2,72,310	2,72,310	100.00	59.38

Because of the disproportionate growth of the urban population, housing problem in this town has become rather acute. All agricultural lands in and around Pondicherry urban limit are being converted into house building sites and houses are constructed in these low-lying plots without developing them and without any provision of sewage system. As a result, the old canals constructed during the French colonial period do not receive the effluents from these new housing colonies. They are let out in the open. During the past 15 years nearly 52 colonies have come up like this without any basic amenities and effluent water filling the numerous vacant plots. Numerous cess pits and kutcha drains have sprung up in all the colonies (Fig. 12).

As the land price started soaring up because of the increase in urban population and higher demand for house sites, many people purchase low-lying agricultural lands more for speculation than for house construction. Therefore many low lying vacant plots are present in all the colonies.

10. 6. 7.

There are three agencies which are concerned with the development and construction of new housing colonies.

The Pondicherry co-operative Housing Society purchases land, are supposed to develop it and sell house building sites to its members on a non-profit basis. The Pondicherry Housing Board is specifically meant for catering to the needs of the State Govt. Emlpoyees of various income slabs. The State Town and Country Planning Authority is supposed to regulate and to enforce the existing rules of providing basic amenities, viz., road, drinking water, drains and lights to the developing colonies before it is given as house sites for construction of houses.

Inspite of these agencies, there has never been any planned development as far as housing is concerned. There are provisions in the existing laws to ensure that basic amenities must be provided in all the colonies before they are sold as house building sites, the rules were rarely adhered to by the promoters or enforced by the authorities. Because of this there are many colonies which have sprung up in an unplanned manner and in all these colonies there are many low lying vacant plots which serve as storage tank for the sullage water from the neighbouring houses and serve as good habitats for mosquito breeding (Fig. 13 to 15).

10. 6. 8. Drainage System :

During the French regime the drainage system primarily consisted of L-shaped drains which collected the household sullage water and these L-shaped drains in turn drained in the U-shaped drains which ultimately led into major drainage/storm water canals. There were six outlets in the eastern side of the city for letting out the sullage water into the sea. These were serving the purpose of drainage without any blockage. With the expansion of the town, the old drainage facilities developed by the French was found grossly inadequate to meet the needs. In many colonies there are no roadside drains to receive the effluents from the houses. Where such drains have been constructed, these had blind ends (Fig 16) as either the gradient was not proper or the work could not be extended to the storm water canals due to reasons which cannot be explained. The Government does provide the funds and gives the necessary administrative sanctions but the planning and execution are invariably faulty.

There are two major drainage/storm water canals in the study area, which were constructed to serve the needs of the sullage as well as storm water disposal.

Name of the canal	*Length*	*Surface Area*
1) Uppar Canal	3000 mtrs.	3968 sq. mtrs.
2) Grand Canal	1510 mtrs.	2460 sq. mtrs.

Fig. 11

Coir pits

Fig. 12

Cess pits

Fig. 13

Low lying vacant plots with accumulation of sullage water from neighbouring houses

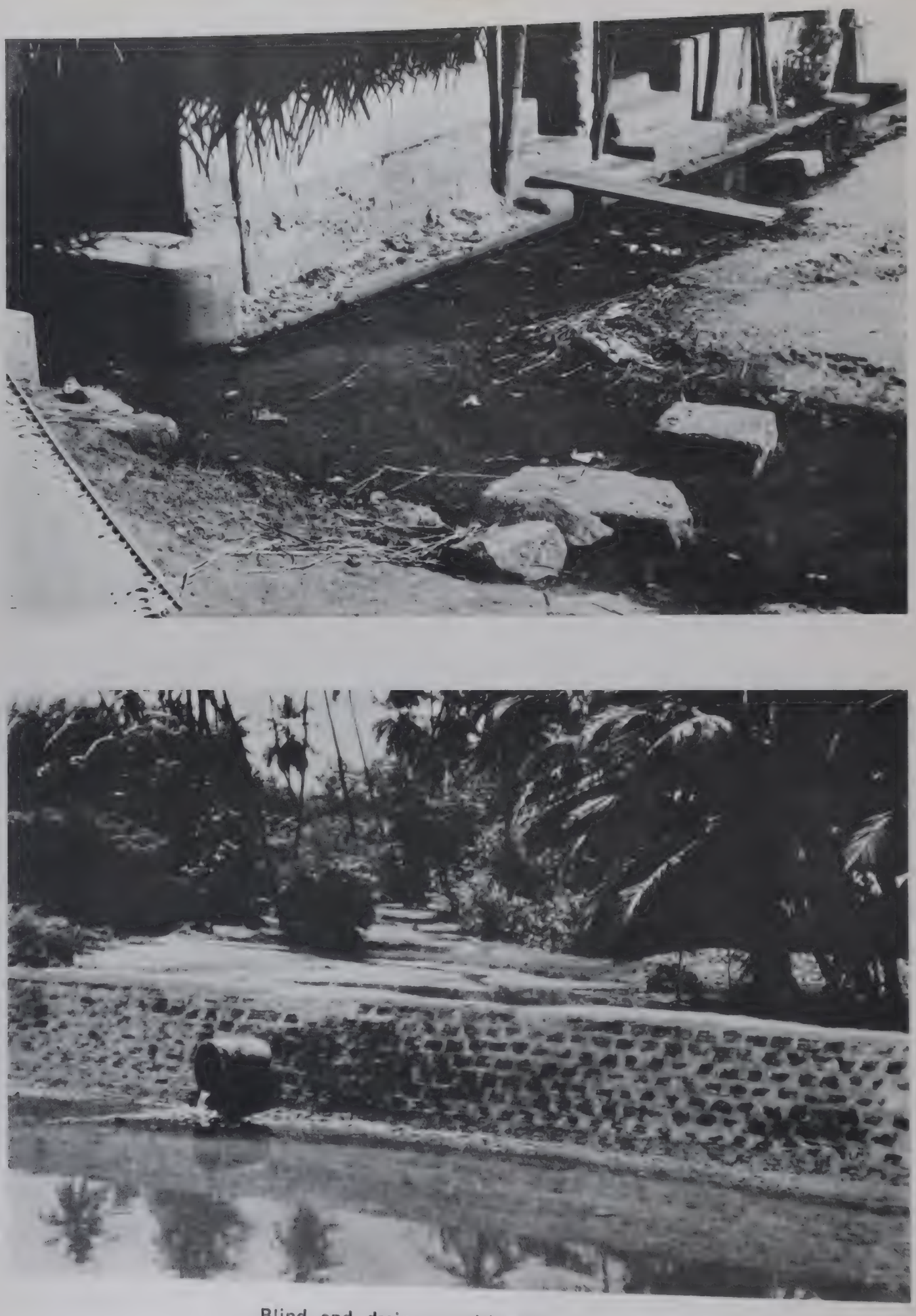
Fig. 14

Unplanned developments leading to water accumulation in a housing colony

Fig. 15

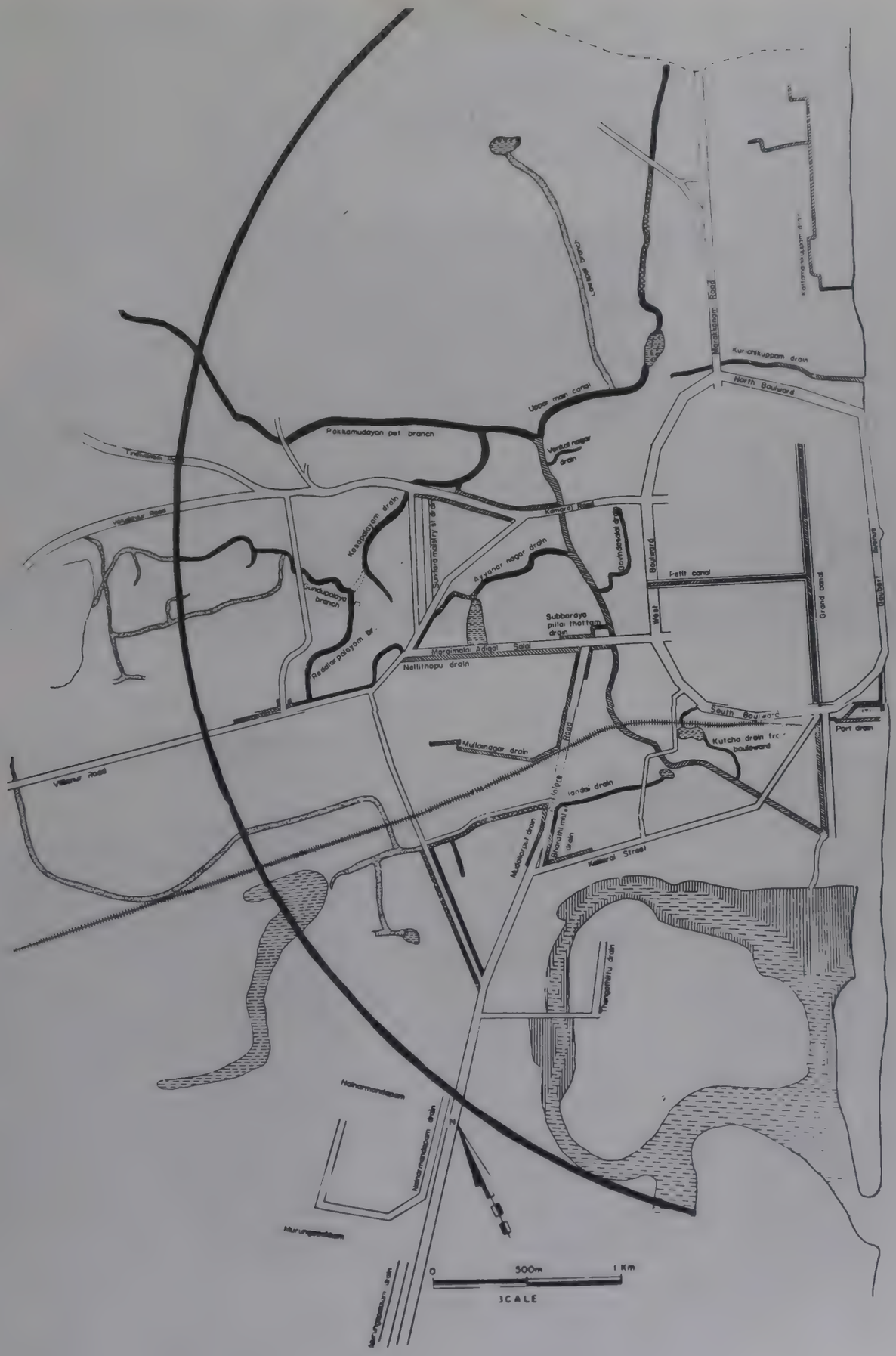
Unplanned development-lack of drainage

Fig. 16



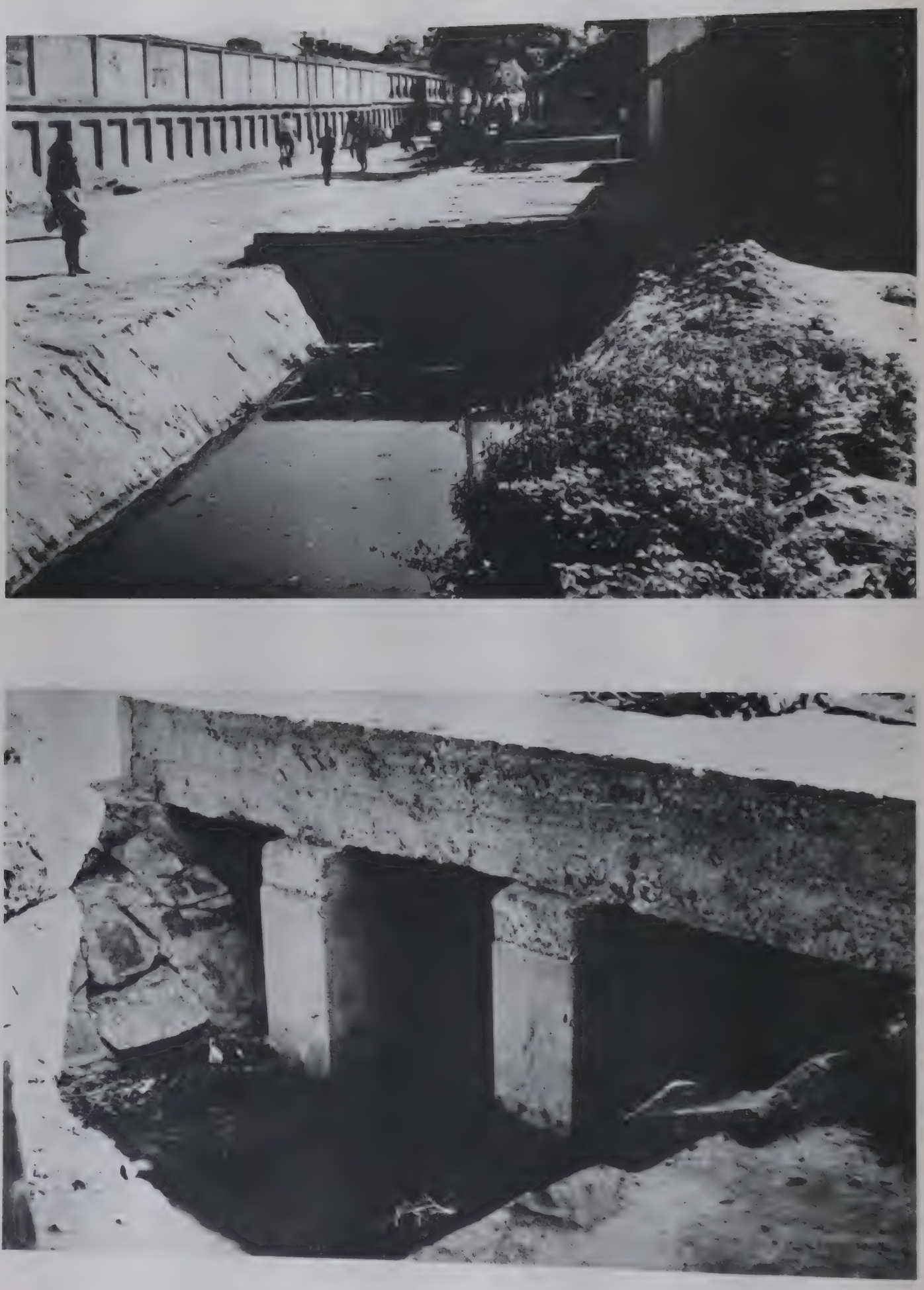
Blind end drains resulting in stagnation of sullage water

Fig. 17



Drainage system in the study area

Fig. 18



Permanent choking in Mill street drain (olandai drain) due to faulty construction

Other than these, there are U shaped drains/canal all round the study area running to a length of about 13.22 kms. The branches are designed to collect the household sullage water through roadside L-shaped drains which run to a length of 90-100 kms. Besides these there are many kutcha drains, which needs immediate attention of the authorities for construction. Further there are also many covered drains which are inaccessible for any type of vector control measures and continues to be highly productive for the filariasis vector.

Some of the problems created by the faulty construction of drains are described below.

Uppar canal

The Uppar canal originates as a rain water collection in the Tamil Nadu State and runs as a kutcha drain upto Venkata Nagar area and thereafter it is a cement lined canal. There are five other storm water drains which also carry sullage water and join the Uppar canal (Fig. 17).

a) Lawspet branch

This is a kutcha channel, collecting sullage water from the Lawspet, Karuvadikuppam area and ends up abruptly as a big pool near T. V. Nagar. Only when the volume of water is large, the water overflows into the Uppar.

b) Pakkamudayanpet branch

A storm water collection canal which also collects sullage water from nearby JIPMER, Jeevanandapuram, Subbaiah Nagar and Thattanchavadi. Though it is coming from a higher to a lower level water stagnation occurs because many large pits (borrow pits) are dug in the bed of this canal for taking soil for construction and as a result water stagnation exists throughout the entire length of the drain.

c) Ayanar koil drain

This is one of the major drains which passes through many colonies. Recently it has been lined partly. All the sullage water collected by this drain is let out into a big pool in the heart of the city from where water sometimes overflows into the Uppar.

d) Olandai drain

This was originally an irrigation channel starting from Olandai lake and running upto Kolas Nagar. When new colonies came up *in this area*, this channel was converted into a drain. This drain, which is lined to a length of only 0.75 km. passes through the main mill area. To have a shopping site over the drain, it was covered with slabs. The breadth at the top of the drain is 3 metres and at the base is 1 metre. To support the slabs pillars were then constructed inside the channel and these pillars occupy more than 75 per cent of the surface area at the bottom. This has resulted in the permanent choking of the drain and as the top is also closed, there was no possibility of cleaning the drain periodically. Hence this canal has become a 'sanctuary' for the mosquitoes of Pondicherry and is an 'engineering marvel' (Fig. 18).

This drain was originally to be connected to Uppar drain in Vanrapet area. When half the stretch of this drain was constructed, it was found that the other stretch of the land is yet to be acquired. So the construction work was stopped and this has resulted in a big pool of dirty water collection in Vanrapet area.

All these smaller drains were designed originally to drain into the two major canals (Uppar and Grand Canal) and which join at the tail end and was supposed to drain into the sea at the south eastern end of the city (Duprayapet). But the gradient was such that the terminal end of the canal was about three metres below the sea level when it reached about 100 metres from the sea. Then the construction work was aban-

doned and in course of time a sand bar has formed at the tail end forming a big pool of dirty water.

Only during the rainy season, the water finds its own course near Veerampattinam which is 2.8 kms. away from the planned exit. Because of this faulty construction an area, 0.5 km radius, has been formed with permanent sullage water stagnation.

Besides these, there exists an underground drainage system designed fifteen years ago. Only about twenty per cent of the house-holders took the connection. Many people who were not satisfied with the functioning of the system have reverted back to the old system. These problems are also discussed in detail elsewhere.

10. 6. 9. Cess pits

In many colonies a cess pit is a common scene in front of each and every house. In some of the colonies, the drainage system will be at a higher elevation than the houses. In short all sorts of non-functional drain designs can be seen which are discussed elsewhere.

10. 6. 10. Wells

There are about 4000 wells in the study area out of which many wells are left unused for a long time and these also contribute to the breeding of the filariasis vector.

10. 6. 11. Public taps

Due to leaky faucets, negligence and often due to pilferage of the taps, water goes on running from the taps creating mosquitogenic conditions all around.

10. 6. 12. Others

Uncovered overhead tanks; empty containers; cisterns etc., which get filled with rain water; tree holes in garden areas breeds many other mosquitoes.

10. 6. 13. Cattle sheds

It is a common sight to find milch cattle in many houses except in the heart of the city. These are tethered either inside the houses or on the roadside. There are about 65,000 cows, 6,000 buffalos, 25,000 sheep and goats and 3,000 pigs. There are no properly designed cattle sheds and which has any arrangement for removal and disposal of cowdung and urine (Fig. 19,20).

Eventhough there is a provision for licensing of cattle sheds, these are not enforced. The Municipal Health Officer has sufficient powers to take action against the defaulters. They are unable to enforce the existing rules. Just to cite one example, one cattle shed was constructed in a residential area without any water disposal arrangement. When this was brought to the notice of the authorities concerned, he issued a notice. Prompt reply came from the owner that he is keeping these cows only as a hobby. But for reasons unknown to us, the matter was never pursued further. These cattle roam about freely, and even the parks and markets are not spared. The buffaloes and pigs which are also abundant are more problematic from the point of view of mosquito. They destroy the bunds of the kutcha canals and pollute the rain water pools thereby creating ideal breeding grounds for *Culex quinquefasciatus* breeding. Political interference with threats of transfer to inhospitable locations, disciplinary actions, and extending favours in cases, are some of the causes for the non-enforcement of existing civic laws.

11. INTEGRATED PEST MANAGEMENT AS A TOOL FOR VECTOR CONTROL

Although the concept of integrated pest management was being advocated since last two decades, it has neither gained importance nor practised in public health,

Fig. 19

Cattle shed without any waste
water disposal arrangement

Fig. 20

Cattle shed without any waste
water disposal arrangement

because of marked preference for (i) 'Rote' operations and for (ii) curative means as opposed to preventive measure. The 'rote' approach to arthropod control operation signified an attempt to achieve abatement by the routine application of insecticide without regard to the habits or abundance of the species. Single chemical method for all purpose were preferred mainly because it is cheaper and unskilled personnel are sufficient to implement and supervise. Control achieved by this process is generally ineffective and temporary in nature.

In contrast, integrated pest management system 'utilizes all suitable techniques and methods in as compatible manner as possible and maintain the pest population at level below those causing economic damage'[53]. If utilized and designed properly, it is more effective and cheaper in long run. In the case of filariasis vector, *Culex quinquefasciatus* complete eradication is neither necessary (since a very high density is necessary to transmit the disease) nor possible[6].

It is well known that successful integrated pest management requires (i) careful appraisal of entire ecological situation, (ii) simultaneous application of various methods suitable, (iii) highly skilled personnel to decide upon the strategies, (iv) continuous monitoring and (v) close coordination of different organizations involved directly or indirectly in control of vectors.

In this programme the following methods of vector control will be used depending upon the particular habitat.

(i) Environmental control and source reduction,
(ii) Biological and
(iii) Chemical methods.

These will be directed towards the immature stages of *Culex quinquefasciatus* for the reasons stated below :

Past experience has shown clearly that *Culex quinquefasciatus* has adapted so much to human association that residual sprays for 20 to 30 years in malaria control programme have not succeeded in bringing down the density. Rather the population increased more and more with increasing urbanization[54]. Their resting in inaccessible areas make adulticides ineffective[55, 56]. Resistance development and incomplete coverage are two main factors which limits the adulticidal application. The habitats of immature stage are well defined. Though the vastness of these breeding area may seem to be staggering, larval control would be easier than adult control with a species like *Culex quinquefasciatus*.

11. 1. Environmental sanitation & source reduction

Environmental sanitation results in source reduction. But this method, in actual practice, is not implemented properly. On the other hand, application of larvicidal oil has been advocated, which in theory, is cheaper and easier. But in actual practice, due to the category of personnel who actually undertake larvicidal measures the whole strategy has collapsed and this is being increasingly realised by all public health people. Secondly, oil is costly in the present day oil crisis, and the logistics involved are rarely satisfactory because of administrative bottlenecks. There is also a reluctance for any change from established practices and therefore numerous imaginary reasons are given why a change in the strategy will not work. Actually, if perfect environmental sanitation is maintainad which is the primary responsibility of civic authorities and the Public Works Departments, there is no need for any insecticide. Further, aesthetically, it is always desirable to have an atmosphere free from the stench emanating from drains which characterises many cities and towns in India. There is always a tendency to blame the health departments whenever an epidemic breaks out or when mosquito nuisance increases. These are only symptoms, the cause lies at some other's door step. Prevention is better than cure.

Since integrated control technology is

contemplated, which involves environmental improvement, two committees have been formed to ensure utmost co-operation from all agencies which will have some role in preventing mosquitogenic conditions.

A. High Level Committee

Health Minister of Pondicherry (*Chairman*)
Chief Secretary
Health Secretary
Secretary, Local Administration (LAD)
Director of Health & Family Welfare Services
Director, Public Works Department (PWD)
Senior Town Planner
Director, V.C.R.C. (Member Secretary)

In the absence of the Health Minister, the Chief Secretary will be the Chairman of the High Level Committee. This Committee will meet once in three months and review the implementation of the Research-cum-Action plan and suggest measures for better implementation. Any difficulty/bottleneck in the implementation of the scheme would be looked into by this Committee.

B Operational Committee

Director of Health and Family Welfare Services (Chairman)

Director, P.W.D.
Senior Town Planner
Municipal Commissioner
Deputy Director (Rural Development), L.A.D.
Director, V.C.R.C. (Member Secretary)

The Operational committee is to meet once a month to closely watch the implementation and initiate measures for its smooth implementation. The first meeting was held on 15 Oct. 1980.

The function of the two committees is to make the different agencies of the Government to act on the following lines.

i) All the major drains and canals should be desilted and deweeded regularly and water flow to be maintained.

ii) Maintenance of a proper gradient, to allow free flow of water, will be cheaper in the long run.

iii) Regarding disposal of waste water including sewage, their discharge into the sea would be most ideal. If this is not feasible, water must be drained from convenient points into the sea by pumping.

iv) Minor engineering works have to be undertaken immediately especially at the confluence of minor and major drains.

v) Ensuring that the damage caused by new roads, works etc., does not result in depression, borrow pits etc., which will collect water and breed mosquitoes.

vi) Cement lining of kutcha drains.

vii) Effective deployment of all their sanitary personnel in consultion with the Director of Health Services.

viii) Effective enforcement of all civic laws which are related to health.

ix) Proper cleaning of road side drains, closing down of disused wells and unnecessary water collections in soakpits.

x) No house construction should be permitted without ensuring proper sanitary facilities and waste water disposal arrangements. House completion certificate should not be issued without clearance from health authorities.

xi) Levelling of low lying areas and closing down unnecessary water pools.

xii) Wide publicity should be given by different agencies in educating the public on preventing mosquitogenic conditions. This campaign has to be sustained on a long term basis, by involving educational and other social welfare agencies.

Suggested role of different department is given in Annexure 1.

11. 2. Biological control

In certain situations, neither source reduction nor chemical control is practicable. An example is the well, which number over 4000 in Pondicherry. Wells form part of the economic life of the people, and therefore the only control method is by introduction of fishes.

The VCRC has studied many agents, including fishes, two species of which are being reared and stocked in adequate numbers. In casuarina pits and some other habitats, where no other method would be practicable, certain tested microbial agents would be introduced.

11. 3. Chemical control

In certain situations, only chemical pesticides would give quick control. The VCRC had studied the current status of vector susceptibility to different insecticides[57,58]. It was found that fenthion is most effective larvicide of choice against the local strain of *Culex quinquefasciatus*. It has also been shown that the persistance of fenthion in polluted water was higher[59] and finally when subjected to fenthion selection it has been found that the chances of resistance development in the near future is very low[60]. Therefore it was decided to use fenthion (Baytex^R 1000) as larvicide.

However in two areas (Zone 1 and 2) malariol and in one area phenthoate will be used for studies on their comparative efficiency.

11. 4. Public participation

Public will be educated through hoardings, posters and films and cinema slides about the mosquito borne diseases so that their cooperation act in a way which will be ensured in the control programme.

It is not the Government efforts alone, but active public participation is necessary. An enforcement machinery is essential which should be advised by a Committee of officials and non-officials. There must be some one responsible from among the citizens in every locality and street who will advise and supervise these cleaning operations and educate the people about preventing mosquitogenic conditions. The whole operation has to be coordinated to bring about a drastic improvement in the environmental sanitation. Otherwise this beautiful city of Pondicherry will not only have to put up with a lot of stench emanating from the drains, but also with mosquito bites and this area will continue to remain highly filarious.

12. PLAN OF OPERATION (ANNEXURE 2 & 3)

12. 1. Preparatory phase (6 months)

12. 1. 1.

Recruitment and training of additional laboratory and field staff will be done in phased manner.

12. 1. 2.

Establishment of additional laboratory/ storage space.

12. 1. 3.

Stocking fishes.

12. 1. 4.

Mass multiplication of microbial agents.

12. 1. 5.

Mapping and marking breeding places.

12. 1. 6.

Formation of Committees.

12. 1. 7.

Procurement of insecticide and equipments.

12. 1. 8.

Standardisation of dose and method of application for microbial agents and insecticides.

12. 1 .9.

Development of operational strategy.

12. 2. Control

Zone No. 1, 2 & 7 will be under the state N.F.C.P. for the operational purposes. The N.F.C.P. will carry out routine larvicidal operation in these three zones with fortified malariol. Zones 3, 4, 5 & 6 will be under operational control of Vector Control Research Centre. In Zone 3, 4 & 6 fenthion is to be used as larvicide whereas in Zone 5 phenthoate is to be used.

12. 3. Evaluation

Pre-control evaluation

12. 3. 1.

Breeding sources in different localities will be marked and detailed maps prepared in order to help control and evaluation teams.

12. 3. 2.

Relative importance of different types of habitats contributing to mosquito emergence has been studied.

12. 3. 3.

Resting density from eighteen fixed catching stations is measured at present. Two man hour collections from each of these stations will be made, once a fortnight and the data recorded in proforma No. 1 (F.C.D.P. - 1).

12. 3. 4.

Man biting rate will be determined from six catching stations once in a week. The data collected will be recorded in proforma No. 2 (F.C.D.P. - 2).

Resting and man biting collection records for all other species will also be maintained in separate cards.

12. 3. 5.

Mosquito dissections will be carried out from the resting and biting collections to study the parity status, vector infection and infectivity rate. The parity rate will also be one additional tool to measure the impact of control operations.

The dissection record will be maintained in proformas 3 & 4 (F.C.D.P. 3 & 4).

12. 3. 6.

Absolute density will be measured for different seasons from the pupal population in different breeding habitats by calculating the daily emergence.

12. 4. Parasitological evaluation

Cross sectional microfilaria survey will be made to determine the prevalence of filariasis among a random sample of the population covering all age groups. The study population will be selected randomly giving proper consideration for suitability, feasibility and availability throughout the study.

Sampling design will be obtained from the Institute for Research in Medical Statistics, Madras. Morbidity pattern will also be assessed from door to door survey with the help of

N.F.C.P. staff and data recorded in proforma No. 5 (F. C. D. P. 5).

12. 5. Awareness among the people

This will be determined by sociological survey from sample population by the distribution of a questionnaire specially prepared. Second survey will be carried out after five years to determine the change in attitude of the people (Questionnaire No. 1).

12. 6. Susceptibility status of vector to different insecticides

Larval and adult susceptibility tests will be continued to know the trend in susceptibility status of the vector in near future, proforma 6 (F. C. D. P. 6)

12. 7. Concurrent evaluation

12. 7. 1.

Resting density-fortnightly from 18 catching stations.

12. 7. 2.

Biting density-weekly from 6 catching stations.

12. 7. 3.

Parity status-mosquitoes collected from the above two.

12. 7. 4.

Infection rate in vector-from the resting and biting collections.

12. 7. 5.

Infectivity rate in vector-from the resting and biting collections.

12. 7. 6.

Absolute density-quarterly from five identical area.

12. 7. 7.

Mf. density-1981. Base line data.

12. 7. 8.

Mf. density-1986. Post control operation data.

12. 7. 9.

Morbidity pattern-1981. Initial survey.
-1986. Final survey.

12. 7. 10.

Larval sampling-evaluation of all the breeding sources like cess pits, cess pools, cement tanks, vacant plots, wells and drains for the breeding of the vector mosquitoes. These reports in turn will help in tightening up control operations in such areas. Data collected and recorded in proformas 7 to 10. (F.C.D.P. 7 to 10).

12. 7. 11.

Species composition of mosquitoes breeding in different habitats will be evaluated by examining samples of 100 adults emerging from field collected larvae.

12. 7. 12.

Since it is a package programme, the impact of the different components of the control programme will be determined from the monthly consumption of insecticide Proforma 11. (F.C.D.P. 11).

12. 7. 13.

Various works that are carried out by the environmental sanitation team like filling,

source reduction, source modification, desilting and manpower spent on each work will be recorded in proforma No. 12 (F.C.D.P. 12).

12. 7. 14.

Impact of environmental sanitation on vector breeding will be assessed by regular monitoring of surface velocity, silt deposition and breeding status. Proforma.13 (F.C.D.P. 13).

12. 7. 15.

Cost benefit analysis/cost effectiveness of different methods will be assessed.

13. STAFF EMPLOYMENT

The following staff have been specially deployed for this project.

Assistant Director (one)

Will assist the Director in the overall planning and execution of the project and will assume full working responsibility. He will also be responsible for liaison with Pondicherry Governmental Agencies.

Research Officer (Two)

(a) One Research Officer will supervise control operation, distribution of spraying equipment and material to the drop points and spot checking of spraying through out the area; maintenance of data and assist in planning.

(b) One Research Officer will supervise entomological evaluation; maintenance of records and assist in study designs.

Assistant Research Officer-One (VCRC)

Will supervise complete adult evaluation and parasitological evaluation.

Research Assistants (Nine) (6 F.C.D.P. + 3 from VCRC)

(a) Two Research Assistants will supervise adult collection, identification, dissection and record maintenance.

(b) Three Research Assistants will carry out larval evaluation in the major breeding habitats. They will also study the larval ecology of a population under pressure, identification, maintain records and analyse data.

(c) Four Research Assistants will look after standardisation of insecticide dosages, maintenance of sprayers and look after their distribution, and supervise spraying operations.

Technical Assistants-Two (VCRC)

One Technical Assistant will carry out random larval survey to detect lacunae in operational efficiency. One Technical Assistant will introduce biological control agents especially in wells and supervise environmental sanitation work.

Lab. Attender (15)

Field collection of adults and immatures, survey of breeding places, under the guidance of R.A. and T.A.

Superior Field Worker (14) (11 SFW + 3 Supervisors)

Eight SFW's will supervise 40 mazdoors in spraying and desilting of drains.

Two SFW's will supervise 10 mazdoors in fish collection and introduction.

Four SFW's will supervise 30 mazdoors in source reduction work, which includes major desilting of drains and filling work in different colonies.

Mazdoor (80)

40 — Chemical control (Spraying)
10 — Fish introduction
30 — Filling and cleaning work

Administrative staff

Office Assistant	— 1
U.D.C.	— 1
Store keeper	— 1
Driver	— 2
Mechanic	— 1

Social Workers

Health education will be carried out through cinema slides, hoardings, posters and public contacts.

Statistical Assistants

Will develop sampling design with the assistance of Director, Institute for Research in Medical Statistics, Madras, and will also analyse the data.

14. ACKNOWLEDGEMENT

Integrated control of mosquitoes for filariasis control is being attempted for the first time in such a large scale in India. Nearly five years of intensive studies on the ecology of the main vector *Culex quinquefasciatus*, and on several aspects of the epidemiology of filariasis has preceeded this 'Research-cum-Action' oriented programme. Prof. V. Ramalingaswami, Director General of Indian Council of Medical Research, has been anxious that the results of all research work in the institutes of the Council must be applied in the field to alleviate human suffering.

The VCRC enjoys the active support and cooperation of the Government of Pondicherry, without which this project could not have been initiated. The Director of Health and Family Welfare Services, Dr. V. Sambasivam, the Health Minister, the Chief Secretary and the Health Secretary have all extended full cooperation. The Director of National Malaria Eradication Programme, had also offered full support from his organization.

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LIST OF E

OF PRO

Activity code	Activities
	PREPARATORY PHASE
101	Hiring building
102	Formation of High Power Committee
103	Formation of Operational Committee
104	Pre-control Evaluation Started
105	Mapping of the Area
106	Procurement of the Materials for laboratory
107	Recruitment of Personnel and training
108	Collection of Parasitological information
109	Collection of Entomological information
110	Standardization of Operational Strategies
	CONTROL PHASE
201	Larvicidal treatment with Fenthion in Zone No. 3, 4 & 5
202	Larvicidal treatment with Malariol in Zone No. 1 & 2
203	Larvicidal treatment with Phenthoate in Zone No. 6
204	Biological Control in Wells & Ponds
205	Environmental Cleaning
206	Source Reduction
	EVALUATION PHASE
301	Absolute Density (Seasonal)
302	Resting Density (Fortnightly)
303	Biting Density (Weekly)
304	Larval Evaluation (Weekly)
305	Evaluation of Efficacy of Minor Engineering works (Periodic)
306	Parasitological Survey (Yearly)

ANNEXURE 2

VENTS AND ACTIVITIES

JECT MASTER PLAN

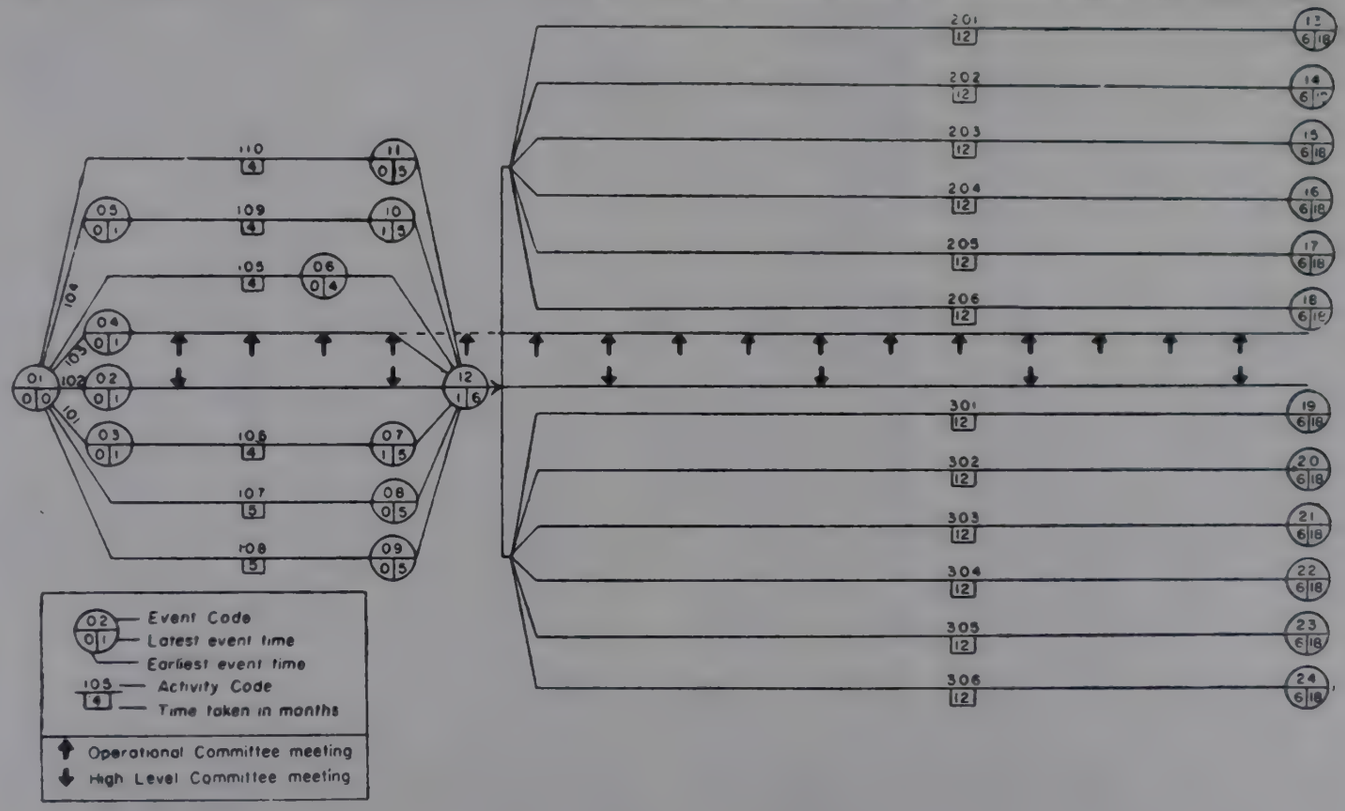
	Event code	Events
		PREPARATORY PHASE
	01	Project Sanctioned
	02	High Power Committee Formed
	03	Building Acquired
	04	Operational Committee Formed
	05	Pre-control Evaluation Started
	06	Maps were drawn
	07	Laboratory Equipped
	08	Recruitment and Training Procedure Completed
	09	Pre-control Parasitological Data Collected
	10	Pre-control Entomological data Collected
	11	Operational Strategy Developed
	12	Preparation Time Over
		CONTROL PHASE
	13	One Year Treatment with Fenthion Completed
	14	One Year Treatment with Malariol Completed
	15	One Year Treatment with Phenthoate Completed
	16	Fish introduced in Wells and Ponds
	17	Environment Cleaned
	18	Source Reduced
		EVALUATION PHASE
	19	Absolute Density Measured
	20	Resting Density Measured
	21	Biting Density Measured
	22	Larval Evaluation Completed
	23	Evaluation of Efficacy of Minor Engineering Works Completed
	24	Parasitological Survey Completed

ANNEXURE 3

FILARIA PROJECT

PROJECT MASTER PLAN

YEAR	1980						1981											
MONTH	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
EVENT TIME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18



QUESTIONNAIRE—1

VECTOR CONTROL RESEARCH CENTRE

(Filariasis Control Demonstration Project)

PONDICHERRY

Dear Citizens of Pondicherry,

In collaboration with the Government of Pondicherry, Vector Control Research Centre, has started 'Demonstration Project' for the control of the filariasis vector in Pondicherry.

To improve the performance of the programme and to know the impact of the programme on the people, certain particulars are needed which are to be furnished by you. The particulars given by you will be utilized only for research purpose and will be kept confidentially.

Kindly co-operate.

Thanking you,
Director

Name :

Sl. No.

Age :

Education :

Address :

Occupation :

Kindly mark the correct answer for the querry in each column.

1 Filariasis is transmitted by :
- 1 Curse of God
- 2 House flies
- 3 Mosquitoes
- 4 Drinking polluted water

2 Diseases transmitted by mosquitoes :
- 1 Filariasis
- 2 Malaria
- 3 Japanese Encephalitis
- 4 Cholera
- 5 Diarrhoea
- 6 Dysentry

3 All the mosquitoes are vectors of some diseases : YES/No.

4	Mosquitoes live in :	1	Clean water alone
		2	Polluted water alone
		3	Both land and water
5	Mosquitoes breed in :	1	Clear water
		2	Polluted water
		3	Stagnant water
		4	Drains
		5	Water tanks and mud pots
		6	Unused wells
6	Convenient dwelling places for mosquitoes :	1	Houses with cattle shed
		2	Houses with garden
		3	Houses surrounded with water
		4	Houses surrounded with garbage
7	Are you suffering from mosquito bites :		YES/No.
8	Persons who help in breeding of mosquitoes :	1	Municipality
		2	Public Works Department
		3	Public
		4	Politicians
		5	VCRC
9	Mosquitoes can be controlled by :	1	Spraying insecticides
		2	Filling of vacant plots
		3	Make the drains to flow freely
10	Who is responsible for free flow of water in the drains :	1	Public
		2	Municipality
		3	Health Department
		4	Public & Government
11	Garbage must be dumped in :	1	Drains
		2	Roads
		3	Neighbour's House
		4	Dust bins
12	Sewage water from my house is let into :	1	My backyard
		2	Road
		3	Next vacant plot
		4	The nearest drains
13	Are you in possession of cattle :		YES/No.
14	Dungs are disposed by :	1	Heaping infront of the house
		2	Making cowdung cakes
		3	Making manures
		4	Throwing in the drains

15 Are you allowing the VCRC staff to spray your house : YES/No.

16 Do you feel that mosquito problem is coming down now : YES/No.

17 Are you satisfied with the work of VCRC : YES/No.

18 If you are not satisfied give your suggestions to improve the programme :

All the particulars will be kept secret. Hence it is requested to give your valuable opinion without any reservation.

F. C. D. P. 1

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria Control Project

Resting Collection

Locality :
Type of house : Pakka house/Huts/Cattle shed
No. of rooms :
Sanitary conditions :
Weather : Cloudy/Rainy/Clear
Time Unit : 5 Mt/10 Mt/15 Mt.
Actual time of collection :

S. No. :
Date :
Collected by :
Identified by :
Supervised by :

House No.	Time Unit spent	Total No. of Mosquito			Species
		Female	Male	Total	*C. quinquefasciatus*

F. C. D. P. 2

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Biting Collection

Species Composition

Date :

Whole night biting collection

Place :

Species	18-19 hours	19-20 hours	20-21 hours	21-22 hours	22-23 hours	23-00 hours	00-01 hours	01-02 hours	02-03 hours	03-04 hours	04-05 hours	04-06 hours	TOTAL

F. C. D. P. 3

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria Control Programme

Dissection Record

Place of Collection :
Type of Collection :
Date :

Dissected by :
Examined by :

Sl. No.	Species	Abdominal condition	Parous	Nulli-parous	Head		THORAX				ABDOMEN				Total Larvae	Total infective stage
					II	INF	MF	–	II	INF	MF	–	II	INF		
1 to 30																

F. C. D. P. 4

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Entomological evaluation

Summary sheet for parity status & infection, infectivity rate

Place of collection :
Type of collection :
Date :

Sunny day/Rainy day
Total Man-hours :

Species	NP	Parous				Dried up	Total No. examined	Total positive	
		1D	2D	3D	Total			Infection	Infectivity

Parous rate :
Infection rate :
Infectivity rate :
Density :

F. C. D. P. 5

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria Control Demonstration Project

Mass blood survey results

Street Name : Date Surveyed :

Surveyed by : Filled by :

Examined By :

S. No.	Name of the person	Father/Husband's name	Door No.	Age	Sex	Result	Remark

F. C. D. P. 6

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Insecticides susceptibility tests

Material tested : Sl. No.
Where collected :
Type of test : First time/routine check/complete retest
Exposure period :
Insecticide used : Conc. of insecticide available
Exposure period :

Tests	Preliminary			Replicate 1			Replicate 2			Replicate 3			Total		
Date															
Temperature															
Concentration	T	D	%	T	D	%	T	D	%	T	D	%	T	D	%

Total No, D = Number Dead, % = If control mortality is betwenn 5% and 25% correct mortality by Abbots formula

F. C. D. P. 7

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Larval evaluation report

Locality : zone No : Date :

Types of Breeding habitat	Location	Stages positive

F. C. D. P. 8

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria control project

Larval evaluation-Cess pit

Locality : Zone No. S. No.

Type of Breeding Habitat Date :

No.	Nature (C) Clear (P) Polluted	No of dips	*C. quinquefasciatus*						Negative	Other species
			I	II	III	IV	Total No. of larvae	Total No. of pupae		

Average No. of larvae IV instar pupae
No surveyed :
No dry :
% +ve
% +ve for IV instar
% +ve for pupae

F. C. D. P. 9

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria Control Project

Larval Evaluation-Drains

Locality : S. No :

Type of Breeding Habitat : Date :

No.	Nature (C) Clear (P) Polluted	No. of dips	*C. quinquefasciatus*						Negative	Other Species
			I	II	III	IV	Total No. of Larvae	Total No. of Pupae		

Average No. of Larvae IV Instar Pupae
Total Length Surveyed :

F. C. D. P. 10

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria Control Project

Well survey

S. No:
Date :
Zone :
Locality : Collection No :

Well No.	Well measurement	Water	Used/ Unused	Fish*		Larvae/dip			Pupae
		Clean (C) Polluted (P) Muddy (M)		Yes	No	Released (No.)	Anopheline	Culicines	

Total breeding surface :
Average number of larvae Pupae per dip (*C. quinquefasciatus*)
Average number of larvae Pupae per dip (Other species)
Gambusia affinis (G)

F. C. D. P. 11

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filariasis control project

Details of the spraying programme

Zone Number : Date :

Sub Zone :

Insecticide used :

Quantity of concentrate used :

Quantity of spray formulations :

Remarks :

Inspected by :

F. C. D. P. 12

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Filaria Control Project

Environmental Sanitation Work

Area :

Filled by :

Type of breeding habitat	Locality of breeding habitat	L	B (in feet)	D	Type of work*	Man hour spent		Amount of work**
						No. of Men	Time spent	

* Cleaning, Filling, Disilting, Deweeding etc. ** Volume of silt removed, Area cleaned/filled etc.

F. C. D. P. 13

VECTOR CONTROL RESEARCH CENTRE
PONDICHERRY

Drain Survey

Locality : Zone No : Date :

KUTCHA DRAIN

Total length surveyed :
Surface Area :
No. of dips +ve for all stages :
No. of dips +ve for IV instar :
No. of dips +ve for pupae :
% of dips +ve for all stages :
% of dips +ve for IV instar :
% of dips +ve for pupae :

U - DRAIN

Total length surveyed :
Surface area :
No. of dips +ve for all stages :
No. of dips +ve for IV instar :
No. of dips +ve for pupae :
% of dips +ve for all stages :
% of dips +ve for IV instar :
% of dips +ve for pupae :

L - DRAIN :

Total length surveyed :
Surface area :
No. of dips +ve for all stages :
No. of dips +ve for IV instar :
No. of dips +ve for pupae :
% of dips +ve for all stages :
% of dips +ve for IV instar :
% of dips +ve for pupae :

PART II

REPORT OF PROGRESS OF WORK

IN THE YEAR

1981

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1. INTRODUCTION

Following the pert plan, the Filariasis Control Demonstration Project completed one year of operations in December 1981. This is a five year project and the objective is to show drastic reduction in the microfilaria rate in the age group 0-8 at the end of 5 years, reduce the biting and resting density to the level at which transmission will become minimal.

The work carried out during the year 1981 and the results obtained are detailed in the following pages.

The work of the project suffered a set back when the casual labourers engaged went on a strike. The project work had to be suspended from 6 July to 3 August 1981. The stoppage of work during this period resulted in an increase in vector density during July and August.

2. MICROFILARAEMIA IN PONDICHERRY

Before assessing the impact of the control measures on the microfilaria (mf) rate in the population, the microfilaria rates both before and after the project is necessary. Since the results from earlier surveys were of limited value, a fresh survey was done.

Total area covered in this survey was 59.38 sq. km. For operational convenience the area was divided into seven zones (Fig.1). Population was estimated for each zone separately from the 1971 census taking into consideration a decennial growth rate of 30.5%. Since the distribution of population is not homogenous, a stratified random sampling with proportional allocation of 10% was adopted. For this purpose each control zone was again subdivided into different blocks and sub-blocks. The population of each sub-blocks was estimated from census figures and a sample size of 10% of the population was fixed (Table I. A). Blood samples were collected randomly from the sub-blocks by finger prick method.

Standard methods were followed for staining and examining the slides. The blood survey was carried out from 8-00 p. m. to 12-00 p. m. The results were presented separately for each block. The mf rate, mean microfilaria density and median microfilaria density were also calculated following standard methods. Age and sexwise distribution of microfilaria carriers was also analysed. Though no special attention was paid to detect chronic cases, whenever such cases were noticed, they were recorded.

Zone and blockwise samples taken are summarized in Table I. A. The regression equation for MfD 50 are summarized in Table I. B. A total of 25,254 slides were collected from the seven zones. Out of these, 2,169 slides were found to be positive for microfilaria thereby giving an overall mf rate of 8.59. Average mf density was found to be 10.72 and highest mf count of 280 was recorded in one case. Zone 1 showed the lowest mf rate and zones 2 and 3 the highest. When blockwise mf rate was considered it was found that in areas where poorer sections of the society live, the mf prevalence was very high. (Fig. 1-Each block is shaded according to their microfilaria rate).

Sexwise and agewise distribution of cases showed a slightly higher prevalence rate among the males in comparison to females Agewise analysis showed a higher prevalence in the age group of 15-30 (Table 2).

In the present study median mf density (mfd 50) was found to be 4.39 and average mf density of 10.72 which is also low in comparison to previous surveys, though the average microfilaraemia in overall population is 8.59. There are pockets where mf rates

15-20 percent are found and these areas are characterised by high mosquitogenic conditions. This survey indicates that the poorer section of the population were more susceptible because of higher exposure to mosquito bites (Table. 3).

In order to assess changes in filaria situation in last two decades the present data were compared with that of the two earlier surveys carried out in 1960 and 1972 respectively. In zone 1 which corresponds to Pondicherry town of 1960, the survey showed a declining tendency (5-7) in comparison to 10.33 being earlier microfilaraemia rate. This can be attributed to increase in population due to influx of non-mf carriers. Similarly Ariankuppam commune also showed a lower tendency but the data are not comparable because in present survey only Ariankuppam was surveyed whereas in 1960 survey a group of 7 villages were also included. Pondicherry commune of 1960 which is now included in Pondicherry town itself consists of Dubrayapet and areas of Muthialpet which showed an increasing tendency.

Infectivity potential of human population to vector population were calculated following methods of Sasa & Suzuki 1974, and found to be 3.74% for whole population (Table. 4).

TABLE 1-A

Zonewise & blockwise blood smears collected and mf. rate.

Zone No.	Block No.	Population	No. sampled	% sampled	No. +ve	mf rate	Average mf density	Mfd 50
1	2	3	4	5	6	7	8	9
Zone 1	1	5828	252	4.32	14	5 56	7.21	
	2	20672	1415	6.85	92	6 50	12.15	
	3	13284	1363	9.98	59	4.33	7.49	
	4	18182	2341	12.88	144	6.15	8.16	
		58056	5371	9.25	309	5.75	9.15	4.24
Zone 2	1	1282	122	9.52	13	10.66	19.92	
	2	4004	205	5.12	31	15.12	15.45	
	3	12730	1411	11.08	178	12.61	13.04	
	4	7507	832	11.08	96	11.54	12.08	
	5	4173	166	3.98	12	7.23	4.08	
	6	10260	855	8.33	63	7.37	9.56	
		39956	3591	8.99	393	10.94	12.39	4.81

1	2	3	4	5	6	7	8	9
Zone 3	1	9406	948	10.08	116	12.24	14.22	
	2	716	101	14.11	2	1.98	2.50	
	3	5943	809	13.61	94	11.63	9.40	
	4	4692	596	12.70	64	10.74	10.72	
	5	2588	184	7.11	30	16.30	14.67	
	6	1677	310	18.49	26	8.39	7.85	
	7	6035	566	9.38	69	12.19	8.97	
	8	4011	363	9.05	22	6.06	8.82	
		35068	3877	11.06	423	10.99	11.07	4.61
Zone 4	1	5617	414	7.37	32	7.73	6.06	
	2	2011	322	16.01	14	4.35	8.71	
	3	1186	85	7.17	15	17.65	16.47	
	4	2294	229	9.98	19	8.30	8.99	
	5	6874	1061	15.43	91	8.58	13.12	
	6	3087	298	9.65	23	7.72	8.11	
	7	2082	242	11.62	19	7.85	13.00	
		23151	2651	11.45	213	8.03	11.08	4.36
Zone 5	1	7771	404	5.20	42	10.40	12.09	
	2	6157	815	13.24	112	13.74	17.5	
	3	7931	1004	12.66	65	6.47	8.2	
	4	10220	1235	12.08	134	10.85	8.66	
	5	6352	515	8.11	52	10.09	9.06	
	6	11085	1051	9.50	101	9.59	9.93	
	7	1065	90	8.45	1	1.11	2.0	
	8	1780	153	8.60	8	5.23	10.0	
	9	4161	307	7.38	21	6.84	7.76	
		56523	5576	9.87	536	9.61	10.97	4.42
Zone 6	1	8758	754	8.61	46	6.10	10.72	
	2	3321	549	16.53	35	6.38	8.60	
	3	940	117	12.45	15	12.82	8.40	
	4	16613	1539	9.26	112	7.28	9.46	
	5	14055	376	2.68	29	7.71	9.24	
		43687	3335	7.63	237	7.10	9.49	4.44
Zone 7	1	10278	853	8.30	58	6.99	6.59	2.71
Grand total		266719	25254	9.47	2169	8.59	10.72	4.39

TABLE 1-B

Regression equations for MFD 50.

Zone 1	Y	=	3.82	+	1.8848 log	×	4.24
Zone 2	Y	=	3.81	+	1.7383 log	×	4.81
Zone 3	Y	=	3.74	+	1.9050 log	×	4.61
Zone 4	Y	=	3.87	+	1.7600 log	×	4.36
Zone 5	Y	=	3.82	+	1.8313 log	×	4.42
Zone 6	Y	=	3.74	+	1.9500 log	×	4.44
Zone 7	Y	=	4.22	+	1.8050 log	×	2.71
Total population	Y	=	3.84	+	1.8122 log	×	4.39

TABLE 2.

Age and sexwise distribution of microfilaria positive cases in Pondicherry

	No. examined	No. +ve	mf rate	Average mf density	No. examined	No. +ve	mf rate	Average mf density	No. examined	No. +ve	mf rate	Average mf density
0-4	442	3	0.68	5.67	401	5	1.25	6.00	843	8	0.95	5.88
5-9	1691	80	4.73	12.56	1552	77	4.96	11.29	3243	157	4.84	11.94
10-14	2110	176	8.34	10.65	1892	169	8.93	11.34	4002	345	8.62	10.99
15-19	1891	213	11.26	10.49	1685	169	10.03	11.91	3576	382	10.68	11.12
20-24	1513	195	12.89	12.55	1486	141	9.49	10.47	2999	336	11.20	11.68
25-29	1213	147	12.12	12.20	1306	118	9.04	9.57	2519	265	10 52	11.03
30-34	873	98	11.23	8.62	939	67	7.24	7.62	1812	166	9.16	8.21
35-39	640	47	7.34	7.77	848	72	8.49	6.06	1488	119	8.00	6.74
40-44	561	52	9.27	14.77	699	49	7.01	13.92	1260	101	8.02	14.36
45-49	450	45	10.00	9.31	617	44	7.13	7.91	1067	89	8.34	8.62
50-54	378	38	10.05	11.79	428	38	8.88	7.95	806	76	9.43	9.87
55-59	282	26	9.22	10.35	303	16	5.28	8.63	585	42	7.18	9.69
60-64	255	18	7.06	9.94	257	24	9.34	10.67	512	42	8.20	10.36
65-69	146	16	10.96	13.56	122	7	5.74	11.00	268	23	8.58	12.78
70 and above	191	13	6.8	10.23	83	5	6.06	10.20	274	18	6.57	10.22
	12,636	1167	9.24	11.15	12,618	1,002	7.94	10.22	25,254	2,169	8.59	10.72

TABLE 3.

Zonewise frequency distribution of microfilaria positive cases in Pondicherry with different mf density

mf Density	Number of cases in							Total positive cases
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	
1	54	57	76	32	79	30	11	339
2	44	43	53	28	75	33	17	293
3	26	47	35	24	57	27	5	221
4	19	22	21	17	34	23	4	140
5	19	31	27	15	40	14	3	149
6	19	19	27	12	28	11	1	117
7	16	15	17	7	20	11	2	88
8	9	16	18	5	22	6	2	78
9	9	9	12	3	13	10	1	57
10	12	10	7	5	14	9	0	57
11-20	49	64	65	35	71	36	8	328
21-30	18	26	29	9	34	13	3	132
31-40	5	12	13	9	26	7	0	72
41-50	4	2	10	3	12	2	1	34
51-60	4	6	5	4	2	2	0	23
61-70	0	6	2	2	4	1	0	15
71-80	0	2	4	1	2	0	0	9
81-90	1	1	1	0	1	0	0	4
91-100	0	2	0	1	0	1	0	4
101-200	1	2	1	1	1	1	0	7
201-300	0	1	0	0	1	0	0	2
Total	309	393	423	213	536	237	58	2169
MfD 50	4.24	4.81	4.61	4.36	4.42	4.44	2.71	4.39

TABLE 4.

Infectivity potential of a human population for the vector population

Direct method					Indirect method	
mf Density per 20 mm blood	Probability infective (P)	No. of cases	No. infective	Cumulative % C %	% Difference between successive classes (D)	p x d
0.1	.0952	339	32.37	15.63	15.63	1.49
0.2	.1813	293	53.12	29.14	13.51	2.45
0.3	.2952	221	65.24	39.33	10.19	3.01
0.4	.3297	140	46.16	45.78	6.45	2.13
0.5	.3935	149	58.63	52.65	6.87	2.70
0.6	.4521	117	52.79	58.05	5.40	2.44
0.7	.5034	88	44.30	62.10	4.05	2.04
0.8	.5507	78	42.95	65.70	3.60	1.98
0.9	.5934	57	33.82	68.33	2.63	1.56
1.0	.6321	57	36.03	70.95	2.62	1.66
1.1-2.0	.7484	328	245.48	86.08	15.13	11.32
2.1-3.0	.9057	132	119.55	92.16	6.08	5.51
3.1-4.0	.9660	72	69.55	95.48	3.32	3.21
4.1-5.0	.9875	34	33.58	97.05	1.57	1.55
5-1 and above	.9967	64	63.79	100.00	2.95	2.94
		2169	997.26			43.53

No. of people examined	25254	
Microfilaria rate %	8.59	
Infectivity Index(%) of mf positive persons (IIP)	45.98	43 53
Infectivity Index(%) of total population	3.95	3 74

3. ENVIRONMENTAL MANAGEMENT

Environmental management includes many aspects like filling of cess pits, removal of unwanted water collections, construction of drains, maintaining drains free from silt and maintaining the flow of water at such a rate that there will be no breeding. Minor engineering works like providing gradient in the drains, providing proper exit and repair of breakages etc. were also attempted. This involved participation of other departments like Public Works Department (construction and repair works) and the concerned Commune Panchayats in the maintenance of constructed drains. Though this is a permanent way of improving the environment, this needs large financial inputs and the will to do things by the concerned officials. The procedure of getting minor engineering works and other improvements done by the concerned departments takes time. Since the project could not afford to wait for these improvements to be carried out departmentally, the VCRC itself undertook these repairs on an emergency basis.

Equipment used for environmental sanitation :

For filling: spades, showels, forks, crow bars and cast iron pans.

For desilting and cleaning of drains : brushes, scrappers and showels.

In addition, a 5 H. P. Diesel pump was used for draining water from the pools before filling.

Staff deployment :

Three teams each headed by a Superior Field Worker were deployed.

Team No.	*No. of mazdoors*	*S. F. W.*	*Work*
1	6	1	Desilting of major drains in Zones 3 & 4
2	6	1	Desilting of major drains in Zones 5 & 6
3	10	1	Filling work

Apart from these regular teams, special squads were deployed additionally from the chemical control team whenever situation warranted.

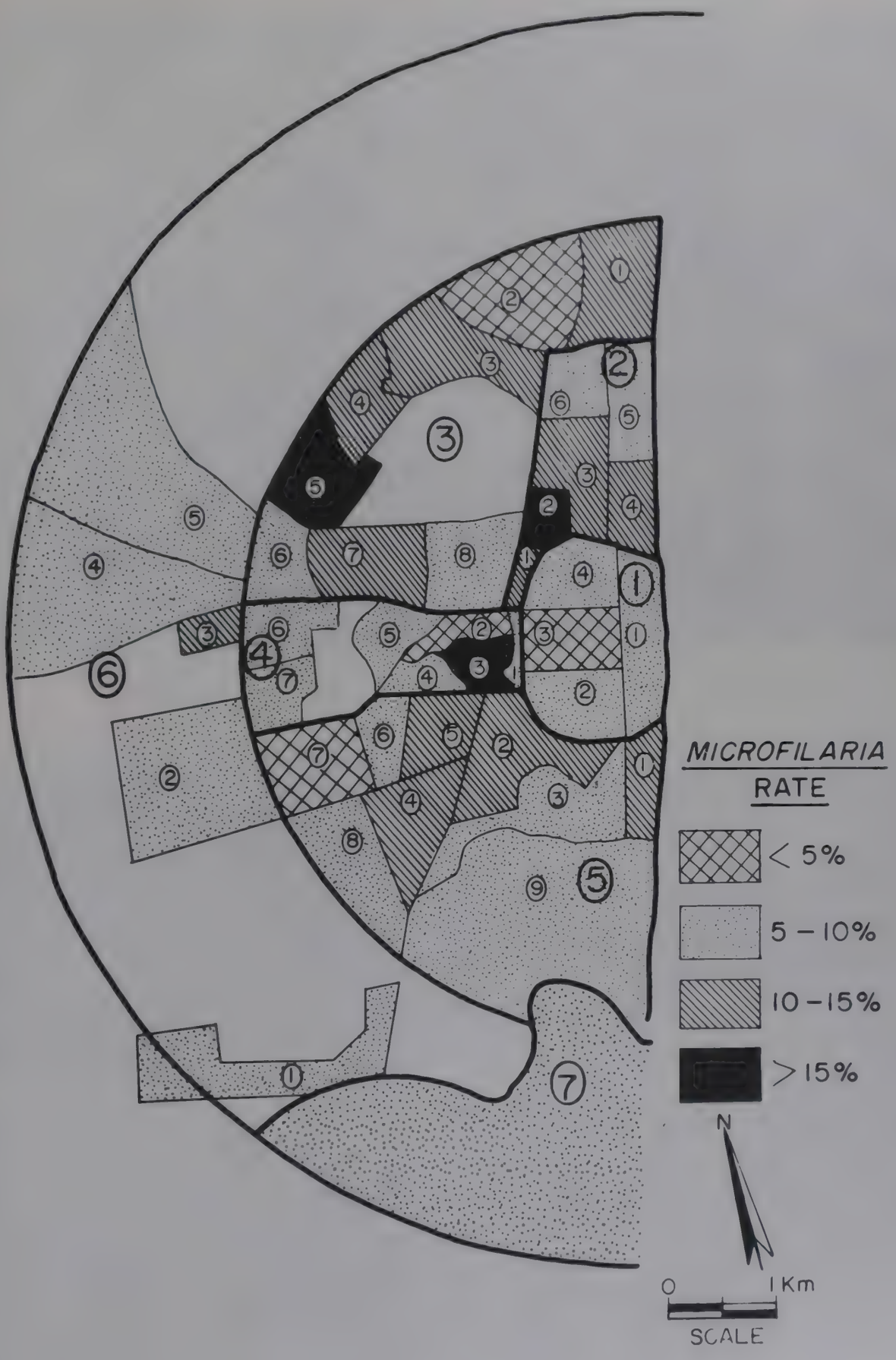
Filling :

Filling is one of the most satisfactory and permanent method for elimination of mosquito breeding places. Silt, sand and waste materials (garbage, etc.) collected by municipalities were used as filling material. These materials were available in plenty in certain localities, and this has been used in the places concerned. This kind of filling was done in the following areas.

Duprayapet :

As there was no exit for the sullage water from the two major canals (Uppar and Grand) the water started spreading into the nearby lowlying areas and such water collections were used for soaking coconut husks for making

Fig. 1



Microfilaria rate in the study area

Fig. 2

Drains being desilted and coir pits being filled

Fig. 3

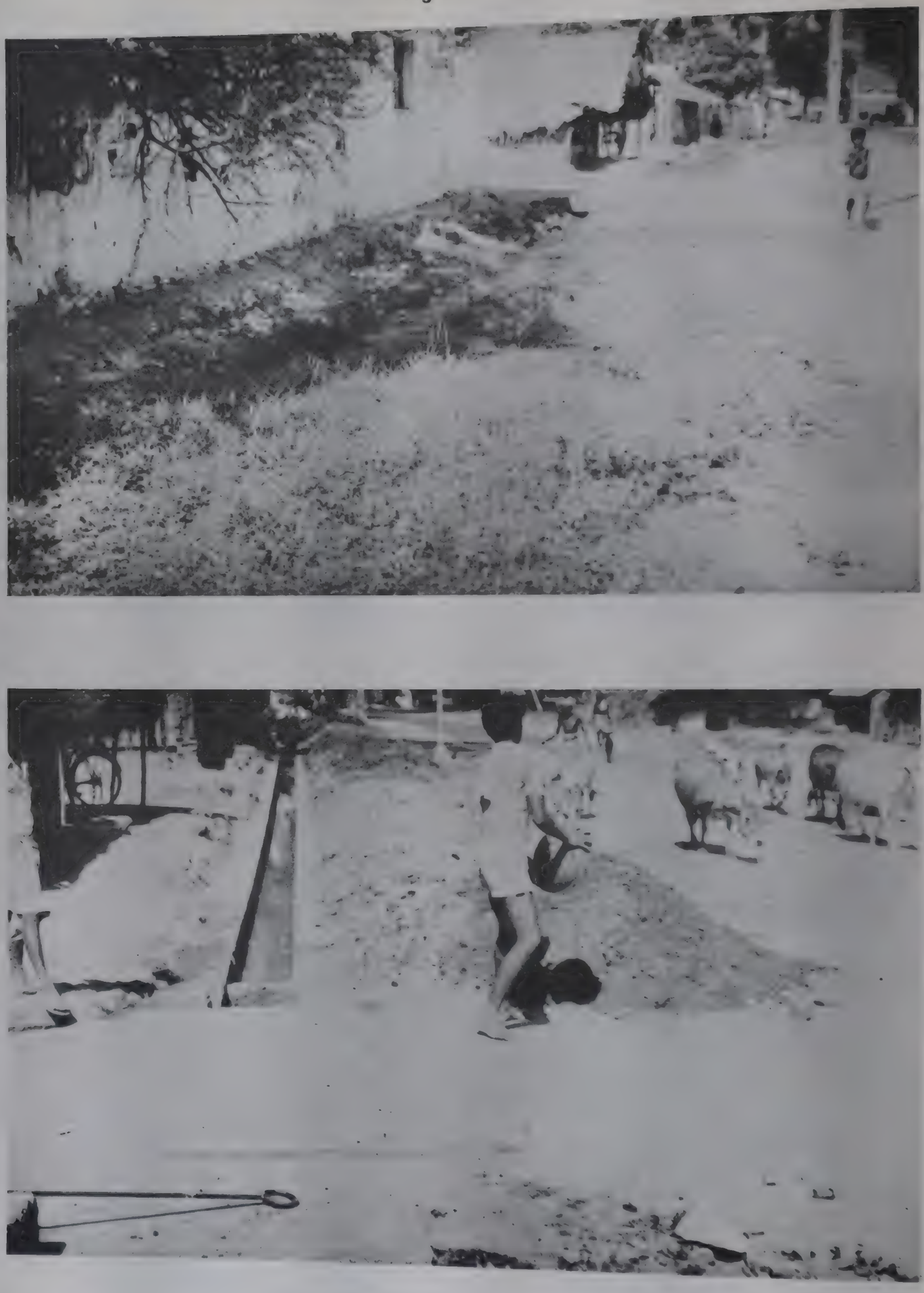
Duprayapet coir pits before filling
Same site after filling and construction of pump house

Fig. 4

Duprayapet swamp being filled and levelled by a bulldozer
Same site after reclamation and planting casuarina

Railway campus before and after filling and construction of pucka drainage canal

Fig. 7



Muthirapalayam U. drain before and after desilting

Fig. 8

Storm water canal - before and after deweeding

Fig. 9

Water being pumped out of a low lying vacant plot
Larvivorous fish release in vacant plots

coir. This practice was being followed by the local people for the past 10 years. These coir pits, numbering about 150, served as the major breeding ground for mosquitoes. After a preliminary survey it was decided to fill the pits with the available sand from the nearby sand bar and close the pits permanently. The help of the Pondicherry Municipality was also sought to dump the garbage and waste soil in the pits and they also helped. The Public Works Department helped by providing a tipper to transport the sand from the sand bar. The work was started on 21st February 1981 and all the VCRC staff and mazdoors were engaged for the work regularly. The work of filling the pits was completed on 28th March 1981.

The filling of the coir pits resulted in the source reduction to the tune of about 2301 sq. metres of surface area. However, since the area was low-lying when compared to the surrounding area, this was getting filled with rain water. It was felt necessary to raise the level of this area. Initially, the municipality was asked to dump all garbage and waste soil in that area. Since this process was time consuming, a bull dozer was hired by the VCRC from the Agricultural Department in September 1981, and the whole area was levelled permanently. Casuarina trees were planted by the VCRC in this area.

Govindasalai area :

Govindasalai is another low-lying area situated in the heart of the town with numerous vacant sites. The slum dwellers on all sides of the vacant plots let out waste water into these vacant plots. Numerous cess pools have been formed and this serves as breeding site for mosquitoes. It was decided to close as many cess pools as possible with the available soil in that area without digging any borrow pits. Two cess pools near Chinnapoigai, one in the school street and another near the toddy shop were closed permanently by the VCRC. The breeding surface area has been reduced by 1300 sq. metres utilising about 1481.77 cubic metres of waste soil.

Venkata Nagar & Kamaraj Nagar :

Venkata Nagar and Kamaraj Nagar are newly developing housing colonies developed from low-lying agricultural lands. The house sites are distributed to various owners by the Co-op. society, more for speculative purposes than for construction. Nearly 25 per cent of the plots were lying vacant and are low-lying The sullage water from the nearby houses are let out in these vacant plots and this serves as breeding ground for mosquitoes.

Hence it was decided to close as many vacant plots as possible with the garbage available from that area itself. The Ozhukarai Commune Panchayat was asked to dump all the garbage and waste soil in the nearby vacant plot itself. By this way a deep pond with an area of about 266.66 sq. metres was filled up with 388.88 cubic metres of silt.

Besides these major filling works, many other smaller works were also undertaken which are detailed in Table. 5.

Environmental manipulation

a) Desilting :

Even though desilting and cleaning are the responsibility of the concerned civic authorities, almost all the drains in Pondicherry were found to be choked with silt and garbage when the project was started. After the initial futile attempts to persuade the authorities to do the cleaning job regular desilting work was undertaken by the VCRC itself in 33 major drains in Pondicherry running to a total length of about 13.22 kms. (Table. 6).

b) Alteration of surface velocity of water in drainages :

As the filariasis vector does not prefer running water for oviposition, an attempt was made to maintain the drain free of

breeding by weekly cleaning and desilting. Because of regular desilting and cleaning the surface velocity of the running water in that drain was increased considerably to prevent breeding. The surface velocity of water was monitored at 10 metre intervals starting from one end to the terminal end and the velocity expressed in cms/sec. and depth of silt deposition in cms. every day. There are 15 drains where continuous monitoring of surface velocity, silt deposition rate and breeding status was done. Of these some drains like Orleanpet drain warranted weekly spraying with insecticide also to maintain it free from breeding. The data are summarized in Table. 7. Out of 13.22 km length of U-drains only a stretch of 1.16 km was found to have a good gradient and water flows with the required velocity of 30 cms/sec. to maiatain the drains free from breeding without any insecticide spraying. Remaining length of 12.06 km need to be regraded. Even though the initial cost of repairing and regrading @ Rs. 200/m was found to be a staggering expenditure in the long run it will work out to be the cheapest method of vector control as the cost incurred will be recovered in 20 years' time.

Out of the 33 drains which were being studied, studies were discontinued in 15 drains after one year as it was found that any amount of cleaning will not result in the increase of the water velocity sufficient to prevent breeding of filariasis vector unless major inprovements are made by the government. Hence larval control is being attempted through environmental sanitation only in the selected drains as listed in Table 8. The data on the sanitation work carried out during the year 1981 are presented in Table. 9.

Minor Engineering Works:

As stated earlier incomplete drains are the major problem. The VCRC dug channels to connect the drains with the nearest canal in many localities which are summarized in Table. 10.

The VCRC started pumping out water from low-lying areas wherever the volume of water was large and where no other control measures were possible.

Vacant plots

There are about 690 vacant plots in 21 newly developing colonies which accounts for a surface area of about 1,38,000 sq. metres. These vacant plots are low-lying and hence they accumulate rain water as well as sullage water from the neighbouring houses and these were found to serve as breeding ground for filariasis vector. The VCRC pumped out water from many vacant plots after the rainy season and the plot owners were asked to fill up the same immediately. Wherever filling up was found to be a long term process the plots were deweeded, sides were trimmed and fishes released at the rate of 1000 fishes/plot of the size of 60'x40' to bring down the breeding. The data are presented in Table 11 & 12.

Even though pumping of water from the vacant plots is being attempted, this is not a permanent source reduction work as the emptied plots gets filled up with water during the rains if left unfilled by soil. Hence the plot owners were approached before pumping and some of them came forward to fill the plots with sand/soil.

TABLE 5.

Major filling work done by the V. C. R. C. during the period from January 1981 - December 1981

Area	Total surface area reduced in m^2	Vol. of filling material used in m^3	Manpower spent in days	Insecticide saved/annum in litres	Insecticide saved per annum in rupees	Cost of man power spent in rupees
Duprayapet (Coir pits)	2301.90	1918.30	548	44.333	5319.96	4384.00
Duprayapet (Cess pool)	1000.00	1000.00	100 + one Bulldozer for 20 hours	19.259	2311.08	800.00 2500.00 (Bulldozer)
Govindasalai (Cess pool)	1066.89	1481.77	327	20.548	2465.76	2616.00
Venkata Nagar, (Vacant plots) Kamaraj Nagar	359.90	482.25	32	6.931	831.72	256.00
Kamaraj Salai (Cesspool)	10.89	35.93	3	0.210	25.20	24.00
Thilagar Nagar (Cesspool)	57.77	9.24	2.25	1.113	133.56	18.00
Vanrapet	26.66	13.33	1.00	0.514	61.68	8.00
Vivekananda Nagar	21.11	23.05	6.00	0.407	48.84	48.00
Bharathi Nagar	405.00	303.75	31.00	7.800	936.00	248.00
Gandhi Nagar	723.18	650.862	150.00	13.928	1671.36	1200.00
Vambakeerapalayam	1660.00	3320.00	111.00	28.756	3450.00	888.00

TABLE 6.

List of drains desilted and surveyed every week

S. No.	Drain	Nature	Lengh & Breadth in metres	Surface area in sq. metres
1	Orleanpet	U	630 x 0.90	567
2	Mullai Nagar	U	90 x 0.30	27
3	Mill Street Swedeshi Cotton Mill	U	760 x 0.90	684
4	Reddiarpalayam	U	840 x 0.50	420
5	Sunchara Maistry St. (L)	U	360 x 0.30	108
6	Sundhara Maiatry St. (R)	U	400 x 0.30	120
7	Gandhi Nagar	U	820 x 0.45	369
8	Muthirapalayam	U	370 x 0.30	110
9	Murungapakkam	U	200 x 0.45	90
10	Nainar Mandapam	U	270 x 0.45	121.50
11	Thengathittu	U	200 x 0.45	90
12	Indira Nagar	U	650 x 0.50	325
13*	Petit Canal	U	790 x 1.50	1185
14*	Grand Canal	U	2050 x 1.2	2460
15*	Uppar Canal	U	2480 x 1.6	3968
16	Mill Street (A. F. T.)	U	650 x 1.00	650
17	Bharathi Mill Street	U	560 x 0.30	168
18	Cuddalore Road (R)	U	530 x 0.45	238
18-a	Cuddalore Road (L)	U	270 x 0.30	81
19	T. V. Bus Stand	U	200 x 1.0	200
20	Vanarapet	U	220 x 1.0	220
21	Park Guest House	U	150 x 0.45	67.50
22	I. T. I.	U	160 x 0.45	72
23	Port Office	U	200 x 0.45	90
24	Iyyanar Koil	U	450 x 1.50	675
25	Lenin Street Left	L	620 x 0.30	186
25-a	Lentn Street Right	L	620 x 0.30	186
26	Reddiarpalayam	K	200 x 0.45	90
27	Kosapalayam	K	520 x 2	1040
28	Saram	K	360 x 2	720
29	Pullianchalai	K	290 x 0.75	217.50
30	Vallalar Street	K	120 x 1.25	150
31	Vengata Nagar I (A. N. H.)	K	370 x 0.60	222
32	Vengata Nagar II	K	150 x 0.50	125
33	Kolas Nagar	K	200 x 0.75	150
	Total :		13220 metres	9764.50

*These canals were not desilted by F. C. D. P.

TABLE 7.

Surface velocity & silt deposition rate in the selected drains

S. No.	Name of the drain	Length in metres	Nature of the drain	Surface velocity in cms/sec.					Average velocity after cleaning	Silt deposition rate in cms/day	Breeding status	
				Before cleaning	After cleaning I Day	II Day	III Day	IV Day			Before cleaning average number of IV instar/dip.	After cleaning
1	Balaji Theatre	200	U	28.48	32.11	31.75	30.34	29.24	30.93	0.33	Nil	Nil
2	Tagore Arts College	1040	U	33.24	30.37	33.56	34.05	38.24	34.05	0.43	Nil	Nil
3	Murungapakkam	200	U	15.86	18.18	18.58	17.15	17.33	17.81	0.33	Nil	Nil
4	Nainarmandapam	270	U	14.02	17.41	16.06	17.35	16.72	16.88	0.47	0.47	0.12
5	Port Office	200	U	14.22	12.55	15.84	14.92	17.37	15.17	0.56	Nil	0.02
6	T. V. Bus Stand	200	U	16.29	20.91	20.20	18.55	18.10	19.44	0.99	Nil	0.09
7	Reddiarpalayam	200	U	16.78	22.18	19.36	26.18	19.21	21.73	0.41	1.93	1.09
8	Muthirapalayam (I)	200	U	10.92	13.19	10.52	14.46	10.93	12.27	1.48	Nil	0.01
9	Muthirapalayam (II)	170	U	12.73	18.34	15.92	15.72	16.61	16.64	0.76	0.02	0.06
10	Thengathittu	200	U	6.92	9.32	8.94	8.95	9.77	9.24	0.45	0.60	Nil
11	Kosapalayam	520	K	15.62	15.83	14.81	14.99	14.88	15.12	1.55	0.29	0.18
12	Venkata Nagar	370	K	18.30	20.06	19.69	19.08	18.55	19.34	2.16	0.04	0.28
13	Vanrapet	220	K	19.61	24.25	22.55	19.80	17.70	21.07	0.69	0.43	0.11
14	Saram	360	K	16.26	17.42	16.00	17.06	15.29	16.44	1.32	0.21	0.07
15	Kolas Nagar	200	K	6.91	7.54	9.93	8.42	8.96	8.71	0.72	0.45	0.49

U - U-shaped puccah drains
K - Kutcha unlined earthern drains
Average of 10 weeks observations

TABLE 8.

List of drains maintained by sanitation alone

S. No.	Drain	Nature	Lengh & Breadth in metres	Surface area in m^2
1	Balaji Theatre opp.	U	120 x 1.0	120
2	T. V. Bus stand	U	200 x 1.0	200
3	Tagore Arts College	U	1040 x 0.50	520
4	Lawspet	U	300 x 0.50	150
5	Indira Nagar	U	650 x 0.50	325
6	Gandhi Nagar	U	820 x 0.45	369
7	Muthirapalayam	U	370 x 0.30	110
8	Mudaliarpet	U	800 x 0.45	360
9	Port Office	U	200 x 0.45	90
10	I. T. I.	U	160 x 0.45	72
11	Kosapalayam pulian salai street	K	520 x 2.0	1040
12	Thengathittu	U	200 x 0.45	90
13	Nainarmandapam	U	270 x 0.45	121.50
14	Murunagapakkam	U	200 x 0.45	90
15	Reddiarpalayam	U	200 x 0.45	90
16	Ayanar Koil drain	U	450 x 1.50	675
17	Venkata Nagar II	K	150 x 0.50	75
18	Ilango Nagar	U	200 x 1.0	200
	Total :		6850 metres	4697.50

	Length in metres	Volume of silt removed in m^3	Man days spent	Cost involved/ week
Work done every week	6850	1370	70	Rs. 600

TABLE 9.

Minor sanitation work done during the year 1981

Month	L-drain in metres	Man days spent	Kutcha drain in metres	Man days spent	U-drain in metres	Man days spent
January	102508.75	146	20404.80	183	--	—
February	43607.37	61	9417.78	44	976.00	9
March	—	—	420.90	8	457.50	10
April	183.00	3	1837.62	50	340.68	16
May	1252.00	9	2557.12	35	344.65	12
June	4802.22	13	1916.30	24	1823.90	12
July	—	—	2203.93	23	—	—
August	18426.99	33	22566.99	94	22698.15	125
September	27769.80	48	16267.50	72	7114.00	29
October	39182.04	43	12733.93	52	5324.85	42
November	38648.38	65	10665.55	47	8716.90	45
December	38629.67	41	41736.20	55	8092.33	36
Total	315010.22	462	142728.62	687	55889.16	336

TABLE 10.

Drains where minor engineering work done for proper flow

Name of the drain	Dimensions in mts.	Man power spent in man days
Kompakkam U. drain	315 x 0.45 x 0.25	50
Murungappakkam U. drain	200 x 0.40 x 0.45	60
Ilango Nagar U. canal	120 x 1.2 x 0.30	100
Venkata Nagar Kutcha drain	240 x 0.60 x 0.30	60
Ashoka Nursing home kutcha drain	310 x 0.90 x 0.15	24
Rainbow Nagar kutcha drain	360 x 0.90 x 0.30	50

DISSERTATION
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TABLE 11.

List of low - lying vacant plots in different colonies in Pondicherry
Period of enumeration : December 1981

S. No.	Place	No. of Plots	No. of vacant plots
1	Kamban Nagar	124	21
2	Bharathidasan Nagar	120	36
3	Indira Nagar	90	21
4	Mullai Nagar	54	26
5	Kolas Nagar	89	9
6	Balaji Nagar & Satya Nagar	85	28
7	Natesan Nagar	120	52
8	Sithankudisai	51	9
9	Anna Nagar	49	37
10	Iyanar Nagar	92	20
11	Shanthi Nagar	83	24
12	Sarathi Nagar	46	14
13	Ilango Nagar	162	13
14	Rainbow Nagar	313	118
15	Chellan Nagar	90	36
16	Suriya Gandhi Nagar	79	31
17	Venkata Nagar	252	42
18	Brindavan	225	58
19	Kamaraj Nagar	299	73
20	Thilagar Nagar Mohan Nagar	128	22
		2451	690

Surface area of vacant plots @ 200 sq. mts / plot 138000 sq. mts.

TABLE 12.

Pumping work done during the year 1981

Date	Place of operation	Volume of water pumped out in litres	Surface area reduced in sq. metres	Diesel utilised in litres	Cost in Rs.	Man power	Insecticide saved in litres/ year	Cost of insecticide saved in rupees
14-9-81	Mohan Nagar	103512	1035.12	1	3.00	8.00	19.94	2391.60
15-9-81	Thilagar Nagar	414048	4140.48	4	12.00	8.00	79.74	9569.11
17-9-81	Thilagar Nagar	103512	1035.12	1	3.00	8.00	19.94	2391.60
18-9-81	Duprayapet	1449168	14491.68	14	42.00	40.00	279.10	33491.89
19-10-81	Solai Nagar	103512	1035.12	1	3.00	8.00	19.94	2391.60
3-12-81	Venkata Nagar	362292	3622.92	3.5	10.50	8.00	69.77	8372.97
4-12-81	Venkata Nagar	621072	6210.72	6	18.00	8.00	119 61	14353.20
5-12-81	Venkata Nagar	517560	5175.60	5	15.00	8.00	99.68	11961.39
7-12-81	Venkata Nagar	646950	6469.50	6.25	18.75	8.00	124.59	14951.73
8-12-81	Venkata Nagar	621072	6210.72	6	18.00	8.00	119.61	14353.20
9-12-81	Venkata Nagar	621072	6210.72	6	18.00	8.00	119.61	14353.20
10-12-81	Venkata Nagar	672828	6728.28	6 5	19.50	8.00	129.58	15549.80
11-12-81	Venkata Nagar	621072	6210.72	6	18.00	8.00	119.61	14353.20

4. CHEMICAL CONTROL

Though the major emphasis of this project is to control the vector by environmental sanitation and source reduction, these methods are time consuming and the results perceptible only after a period of time. They also need the co-operation of other agencies, which has failed to appreciate the urgency of the present project. Since the main objective is to demonstrate complete interruption of transmission of filariasis by keeping the vector population below the critical level, chemical larviciding had to be done in many places to bring about drastic reduction in the vector density in places where other measures like filling, increasing the flow of water, environmental manipulation etc. could not be effected. However, simultaneously various measures were initiated to bring about permanent improvement of the mosquitogenic condition.

Plan of control operations :

As already stated, the whole urban agglomeration of Pondicherry is divided into 7 zones, and zones 1,2 and 7 are under the control of the state N.F.C.P. Routine control measures using M.L.Oil were undertaken by them. Control in zones 3,4,5 and 6 were undertaken by VCRC. Area and population covered by N.F.C.P. and VCRC are given below.

	Sq. kms.	*Population*
N. F. C. P. (Govt. of Pondicherry)	11.34	1,08,290
F. C. D. P. (VCRC)	48.04	1,58,429

For operational convenience, zones 3,4,5 and 6 were divided by the VCRC into 20 larviciding sub-zones and the spraymen were deployed in such a way that each sub-zone was covered weekly with the interval between two successive spraying is not more than seven days. Spray schedules begin at the centre of the heaviest populated area and were planned to move towards the periphery. The operational schedule is shown in Fig. 10 and Table 13.

Staff deployment:

The responsibility for the whole control operation is with one Research Officer, who supervises the control operation in all the zones. Each zone is under the direct supervision of one Research Assistant, who is assisted by two Superior Field Workers and labourers necessary for the spraying operations. Staff deployed for complete coverage within five days for different zones are summarized below. Actual number of people worked in particular day were also recorded to evaluate cost of operation.

	Zone No. 3	Zone No. 4	Zone No. 5	Zone No. 6
Research Assistant	1	1	1	1
Superior Field Worker	2	2	2	2
Spraymen & Scrappers	12	11	9	8

Vehicle :

For the purpose of distribution of sprayers, scrappers and other chemicals needed in the field, two standard vans were deployed to drop all the staff and equipment early in the morning and pick-up all the materials in the afternoon after the work is over. Inspection and supervision of the work was concurrently done by the other scientists.

Equipment and maintenance :

30 Aspee(R) Hand Compression Sprayers of 12 lit. capacity (Code-ACS-4) and 12 SIKAR(R) Knapsack Sprayer (Code SR-28) of 16 lit. capacity were obtained for the operational use. As the sprayers were in constant use, sufficient number of spare sprayers were kept ready for any immediate replacement. Sprayers were washed and cleaned, and the pump oiled every day to maintain it in perfect condition. Spare parts which wears out frequently were kept in readiness for immediate replacement so that no sprayer is put out of use. Cost involved in sprayer maintenance was also recorded for each sprayer separately.

Spray Timings :

In order to avoid spraying during the hottest periods of the day following time schedule was followed for different months.

	Period	Working time
Summer months	March, April, May & June	7-00 a. m. - 11-00 a. m. 2-00 p. m. - 5-00 p. m.
Other months	July-February	8-00 p. m. - 12-00 noon 1-30 p. m. - 4-30 p. m.

Dose determination

In order to determine the minimum effective dosage of Fenthion and Phenthoate, a field trial was taken with 10 concentrations of Fenthion and Phenthoate in cess pits and L-drains. Taking into consideration the volume of water in the cess pits and drains, calculated amount of formulation were sprayed for different concentrations and the time taken to give 100 per cent mortality was observed in different treatments. The observation in cess pits and L-drain are presented separately (Table 14 & 15). To determine the frequency of spraying, persistance of insecticide in different habitats was also studied by bioassay, residual analysis and noting the day of appearance of 1st instar larvae after initial spraying. Concentration of spray solution was determined from the walking speed of spraymen, discharge rate of nozzle at different pressure and target dosage by using standard formula for drains.

$$\frac{\text{Average volume of water covered in one minute} \times \text{Target dose}}{\text{Concentration of solution to be given in sprayer}} = \text{Discharge rate/min. at particular pressure}$$

For pits, time taken for spraying each pit was determined by the following formula.

$$\frac{\text{Average vol. of water in pit} \times \text{Target dosage}}{\text{Concentration of spray solution}} \times \text{Time taken for discharge of 1 ml. solution.}$$

The time varied in different pits depending on the size and volume of water body.

Chemical consumption:

To evaluate cost factor total amount of insecticide used for each round was recorded.

Results:

In order to know the average walking speed of spraymen, 10 spraymen were made to walk normally and the distance covered by them in one minute was measured. The distance covered by the spraymen varied and the average coverage was found to be 125 $\pm$ 10.8 feet / min.

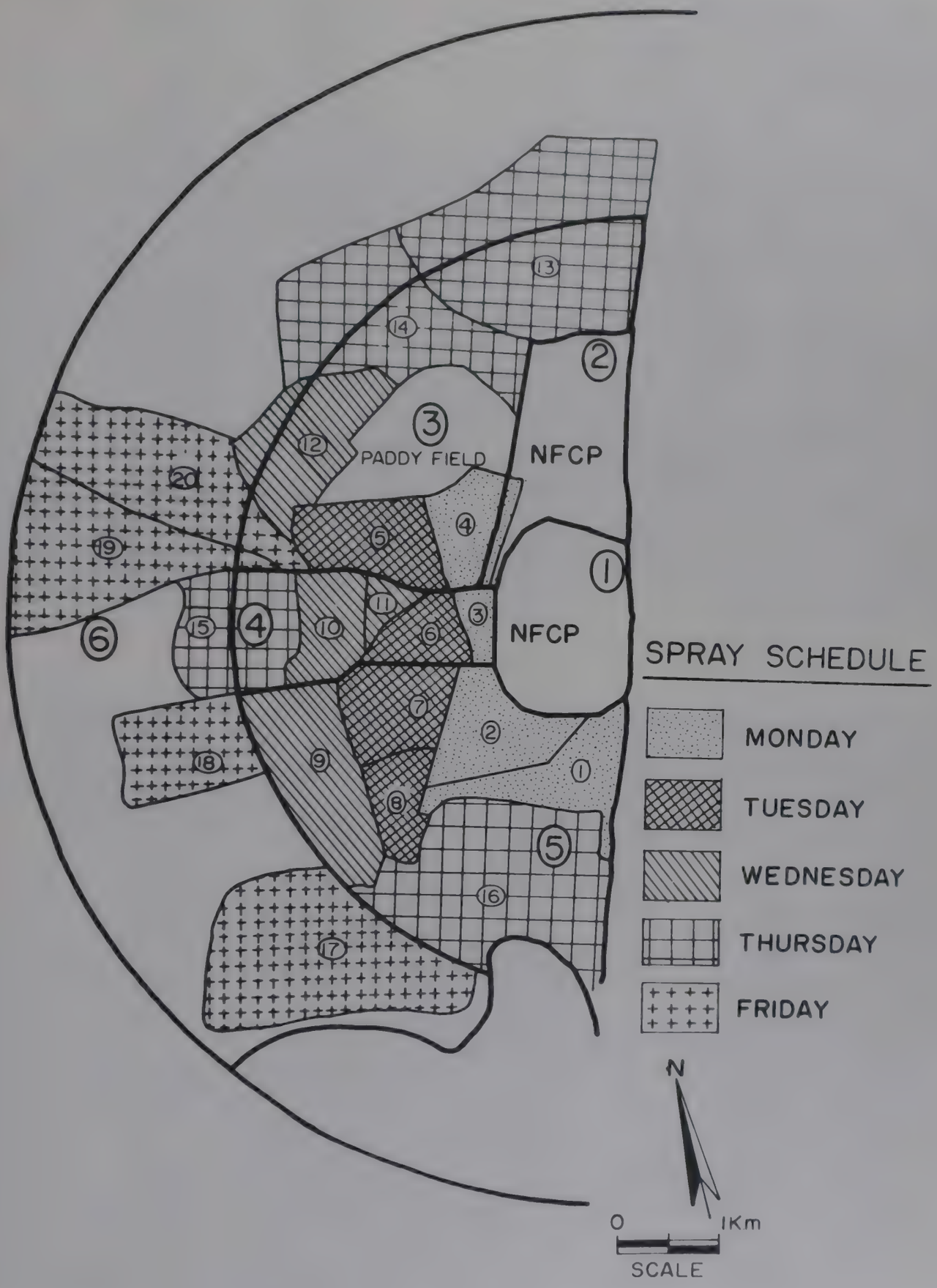
The air pressure in the hand compression sprayer drops very quickly as the spray fluid is discharged and this drop in pressure affects the discharge rate of the nozzle of that sprayer. To find out the safest pressures at which the discharge rate will be constant, the discharge rate at various pressures was measured and presented in Table 16. It was found that the pressure must be maintained between 25 lbs/sq. in. and 40 lbs / sq. in and within the working pressure the average discharge rate of spray fluid in the hand compression sprayer was found to be 825 ml/min. $\pm$ 60.64 ml. / min. In the case of knapsack sprayers, as there is provision for maintaining constant pressures without stopping spraying, the discharge rate was found to be 680 ml / min.

To determine the most effective and economic dose, field trials were carried out and the time taken to get 100% kill in cess pits and drains were tabluated. Residual effect of insecticides at different concentration was also studied and shown in Table 14. From these experiments it was found that a target concentration of 0.5 ppm of Fenthion and 0.5 ppm of Phenthoate is necessary to give a weekly spray schedule. Higher concentrations, though it gives longer residual effect was not found economical, because increase in cost of insecticide consumption is much higher than the cost of labour saved.

From the data that a spraymen will be walking at a speed of 125 feet/min. and the average discharge rate of nozzles as 825 ml/min. and with the target concentration at 0.5 ppm, it was found sufficient to charge the sprayers with 1000 ppm solution of Baytex and Phendal by adding 1.12 ml/lit (82. 5%EC) and 2.0 ml/lit. (50% EC) of the respective insecticides.

The data on the monthwise consumption of insecticide and the surface area covered during the year 1981 are presented Table 17.

Fig. 10

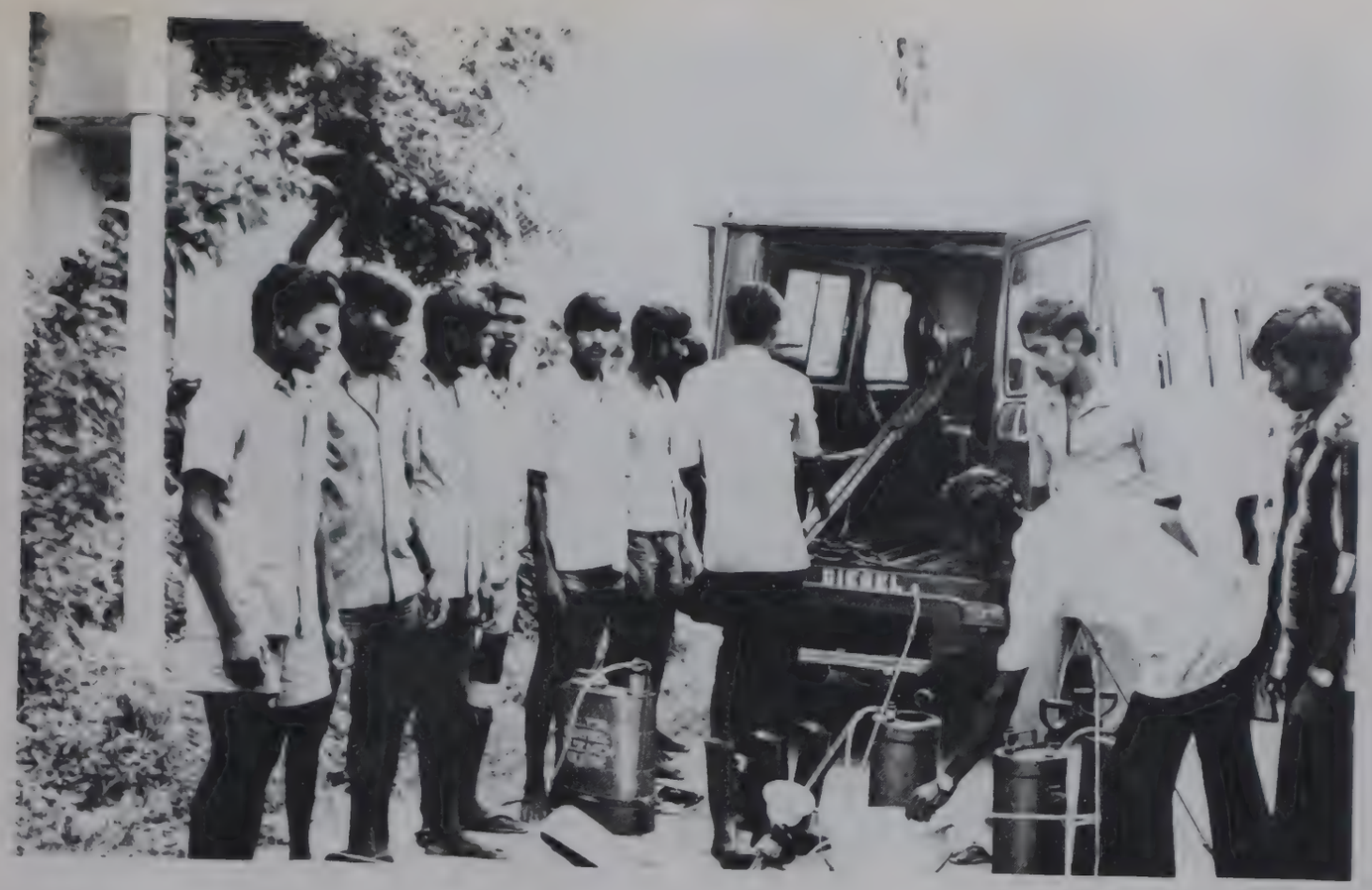


Weekly spray schedule in the study area

Fig. 11

Sprayers and equipments kept ready for field use

Fig. 12



Distribution of sprayers and equipments in the field
Cleaning a cess pit before spraying

Fig. 13

Spraying operation in a cess pit and a drain

TABLE 13.

Weekly spray schedule

Days	Area	Zone	Area	Zone	Area	Zone	Area	Zone
Monday	Rainbow Nagar Suriyagandi Nagar Venkata Nagar	3 3 3	Govinda Salai Main Rd. to West Bouleward Rd. Chinna poigai, Mohan Nagar	4 4	Kolas Nagar Daveed pet Vanarpet	5 5	Vambakeerapalayam Nethaji Nagar I Dubrayapet & Nethaji Nagar II	5 5
Tuesday	Brindavan Saram Tagore Nagar I	3 3 3	Kennedy Nagar Indira Nagar Subbiah Nagar Pudupalayam Ilango Nagar Santhi Nagar Sanjay Gandhi Nagar Ayyannar Nagar	 4 4	Orleanpet Nellithope	5 5	Mudaliyarpt Indira Nagar Bharathidasan Nagar Pattammal Nagar	 5 5
Wednesday	Pudupet, Mariamman Koil St., Lawspet on Madupet Tagore Arts College Tagore Nagar St. Paulpet Rajaji Nagar Jeevanandapuram Raman Nagar Muthulingapet	 3 6	Pillaithottam Mettu Street to Nellithope Corner Pillaithottam Kamaraj Salai to Mettu Street	4 4	Satya Nagar Balaji Nagar and Saram Kosapalayam	 4 5	Keerapalayam Natesa Nagar Boomiyanpet &. Vivekananda Nagar	5 6
Thursday	Kottakuppam - I Chinnakottakuppam Sodhanaikuppam Kottakuppam - II Nadukuppam	3 6	Ellapillaichavadi Mohan Nagar Thilak Nagar Kavundanpalaym Gundupalayam Kasturiba Nagar Pettaiyan Chattiram	 4 4	Karuvadikuppam & Bharathi Nagar Pethuchettipet Chellaperumalpet	3 3	Thengathittu Nainarmandapam	5 6
Friday	Thattanchavadi Subbaiah Nagar Indira Nagar	6	Kathirkammam to Mettupalayam Gandhi Nagar to Kathirkamam	6 6	Ozhugarai Reddiarpalayam Pavalakaranchavady	6 6	Kombakkam Murungapakkampet Murungapakkam	6 6

TABLE 14.

Field trial with Baytex* & Phendal** in cess pits.
Values are means ± S. Ds of 10 observations

S. No.	Concentration used in ppm	Time taken to get 100% mortality of larvae in minutes			
		Baytex	Days after Which IV instar larvae is observed	Phendal	Days after which IV instar larvae is observed
1	0.1	90 ± 5.54	—	60 ± 4.90	—
2	0.2	65 ± 3.37	—	50 ± 10.00	—
3	0.3	58 ± 3.97	—	45 ± 2.51	—
4	0.4	42 ± 4.83	6.0	35 ± 2.42	6.0
5	0.5	35 ± 3.86	6.0	30 ± 2.10	6.0
6	0.6	32 ± 3.91	—	20 ± 1.84	—
7	0.7	25 ± 3.31	7.0	15 ± 1.29	7.0
8	0.8	18 ± 2.15	—	12 ± 1.53	—
9	0.9	15 ± 3.30	—	10 ± 0.97	—
10	1.0	15 ± 3.50	8.0	10 ± 1.71	8.5

* Fenthion

** Phenthoate

TABLE 15.

Field Trial with Baytex* and Phendal** as larvicides in 'L' drains
Values are means and ± S.Ds of 10 observations

S. No.	Target concentration used in ppm	Time taken to get 100% mortality of larvae in minutes	
		Baytex	Phendal
1	0.1	105 ± 6.59	85 ± 3.2
2	0.2	90 ± 3.36	78 ± 1.58
3	0.3	74 ± 2.9	65 ± 2.42
4	0.4	60 ± 3.27	55 ± 2.69
5	0.5	50 ± 3.46	45 ± 3.07
6	0.6	40 ± 2.57	30 ± 3.09
7	0.7	28 ± 1.51	25 ± 2.37
8	0.8	25 ± 2.03	20 ± 1.97
9	0.9	20 ± 2.16	15 ± 2.24
10	1.0	20 ± 1.55	15 ± 1.31

* Fenthion
** Phenthoate

TABLE 16

Discharge rate of spray fluid at various pressures

S. No.	pressure in lbs. /sq. in	Average discharge rate of 20 sprayers in ml/minute	Average discharge rate at working pressures
1	10 lbs	420.25 ± 129	
2	15 ,,	546.14 ± 57.16	
3	20 ,,	635.00 ± 90.61	
4	25 ,,	*754.00 ± 49.30	824.41 ± 60.64
5	30 ,,	*807.00 ± 62.04	
6	35 ,,	*837.40 ± 88.55	
7	40 ,,	*899.25 ± 99.64	
8	45 ,,	990.45 ± 136.27	
9	50 ,,	1008.75 ± 142.28	

*Pressures in which the sprayers will be normally used for spraying.

TABLE 17.

Insecticide consumption and surface area covered during the year 1981

Month	Insecticide consumption (in litres)				Surface area covered (in sq. metres)				Man power utilised in man days Mazdoors-SFW			
	Zone 3	Zone 4	Zone 5	Zone 6	Zone 3	Zone 4	Zone 5	Zone 6	Zone 3	Zone 4	Zone 5	Zone 6
January	12.60	15.60	6.00	—	34033.50	42120.00	16200.00	—	220-44	132-44	132-44	—
February	13.10	14.74	8.50	6.10	35383.50	39082.50	22950.00	16443.00	200-40	120-40	120-40	60-20
March	16.68	25.24	18.81	10.22	45046.00	68148.00	50800.50	27594.00	220-44	132-44	132-66	132-44
April	17.62	19.88	20.62	13.00	47565.90	53692.20	55687.50	35100.00	210-42	126-42	126-63	126-42
May	21.35	21.46	21.62	19.02	57639.60	57942.00	58382.10	51367.50	200-40	120-40	120-60	120-40
June	19.50	21.32	24.66	11.90	52647.30	57586.00	66595.50	32130.00	200-40	142-51	141-51	107-35
July	3.41	3.65	3.10	3.70	9223.20	9855.00	8370.00	9990.00	40-8	24-8	24-12	24-8
August	18.05	16.37	17.80	10.71	48748.50	44212.50	48073.50	26917.00	204-40	122-38	118-41	109-35
September	18.52	17.08	20.46	14.89	50004.00	46116.00	55242.00	40208.40	181-40	124-35	114-39	123-38
October	22.39	21.43	23.59	13.68	60466.50	57861.00	63693.00	36930.60	206-43	141-44	140-45	120-36
November	20.85	17.72	20.56	13.10	56286.90	47844.00	55512.00	35329.50	163-38	107-32	112-40	99-32
December	27.60	22.51	29.16	20.02	74520.00	60777.00	78732.00	54054.00	216-47	151-47	136-47	145-48

5. COMMUNITY PARTICIPATION

Filariasis is an environment related disease and prevalence of this disease directly reflects the sanitary condition of particular place. This disease could easily be prevented with little or no intervention if people are aware of the disease process. Hitherto the measures initiated to check filariasis are more of curative nature. People are responsive to governmental efforts only if there are big epidemics or large number of deaths. When the epidemics are over neither the people nor the governmental agencies try to consolidate the gain by preventing mosquitogenic condition permanently. This approach is not only costly but also non-functional.

To achieve the goal of health for all by 2000 A.D. we have to enlist the active participation of the community for preventing mosquitogenic conditions. A mass public health education programme was initiated through pamphlets, posters, hoarders, cinema slides, door to door health education and regular advertisement through newspapers.

It was felt that the Vector Control Research Centre should directly interact with the people to initiate horizontal level health education. An Opinion Leaders Training Programme was started. The Opinion Leaders were selected from the residents' associations. They were shown mosquito breeding places, and were informed about diseases transmitted by mosquitoes and other aspects. They were asked to be vigilant about the sanitary and health conditions in their area, so that they can take more responsibility about their health not only by demanding the service but doing things themselves, which will be a community service.

An opinion survey was also carried out with the help of questionnaire. One questionnaire was supplied for each house. For distribution of questionnaire stratified random sampling with proportional allocation was followed. The questionnaires were supplied in the local language and whenever necessary the health educator assisted the respondent to fill the forms.

Following actions were taken to enlist community participation.

1 To create awareness among the politicians, the Health Minister, Minister for P.W.D. and Local M.L.A. were taken round the problem areas.

2 Opinion Leaders Training Programme was conducted for the following localities: 1. Gandhi Nagar 2. Kosapalayam 3. Mohan Nagar 4. Nellithope 5. Rainbow Nagar 6. Govinda Salai 7 Orleanpet 8. Mudaliarpet 9 Natesan Nagar 10. Subbaiah Nagar 11. Vivekananda Nagar 12. Venkata Nagar 13. Kamaraj Nagar 14. Kottakuppam 15. Vanrapet 16. Kamban Nagar 17. Uppalam 18. Kathirkamam 19. Vambakeerapalayam 20. Murungapakkam 21. Thengathittu and 22. Raja Udayar Thottam. A total of 100 opinion leaders were trained. The curriculam for opinion leaders' training programme is annexed (Annexure 1).

3 Door to door health education programme is being conducted on a continuing basis. Upto now more than 10,000 people were contacted individually by various members of our staff to make them aware of the problems.

4 6000 pamphlets depicting the dangerous diseases carried by mosquito and how to control them were distributed among the people.

5 Posters: 9000 posters in 3 designs were displayed in various parts of the study area.

6 Hoardings: 20 hoardings (6' x 4') in ten designs were fixed in vantage points. To make them attractive, designs were developed keeping in view the local sentiments and social set up of the people. Since people are religious, some of the hoardings were based on mythological stories (Fig 14-23)

7 To intensify Health Educatien Programme, help of following were also sought and the members were supplied with curriculum of Opinion Leader Training Programme :

Background : This boarding was designed based on a legend

Hoarding No. 1

WE ARE ALL KINGS OF THE NATION

BUT

DO WE NEED A MOAT AROUND OUR HOUSES ALSO ?

Crocodiles in moat around fort will prevent enemies entering !

Mosquitoes in "moat" around our house will kill us !

Hoarding No. 2

Background : This hoarding was designed based on a legend from the Hindu epic 'Mahabaratha', where Arjuna (Pandavas) was having doubts in his mind about killing his relatives, in Kurukshetram battle field. The Lord advises him to have a detached mind and do his 'duty' to protect righteousness.

In this hoarding Arjuna represents Government and Lord Krishna represents people.

KOSU (MOSQUITO) KSHETRA

Arjuna : (Govt) How can I eradicate mosquitoes without your help Lord ?

Lord Krishna : (people) I will look after the environmental sanitation. Don't worry. Take the sprayer and spray insecticides.

Prevent mosquito breeding by doing following things.

1. Do not allow water to stagnate in drains inside the premises and keep the drainage clean by frequent cleaning.
2. Empty tins, containers, drums, pots etc., accumulate rain water, which should be destroyed or emptied once in a week.
3. Cover the water tanks, with slabs.
4. Clean the water tubs, and pots, once in a week.
5. Repair the leaky water taps as it leads to stagnation and mosquito breeding.

நாம் எல்லோரும் இந்நாட்டு மன்னர்களே!

அதற்காக

நம் வீட்டை சுற்றி இப்படி ஒரு அகழி தேவைதானா?

கோட்டை அகழியில் முதலைகள் வளர்ந்தால்
பகைவர் பலியாவர்.
வீட்டு அகழியில் கொசுக்கள் வளர்ந்தால்
நாமே அதற்கு இரையாவோம்.

கொசுத் தடுப்பு ஆய்வு நிலையம் (இந்திய மருத்துவ ஆராய்ச்சி தருகம்)
பாண்டிச்சேரி மற்றும் புதுவை சுகாதாரத் துறை

Hoarding No. 1

கொசு ஒரு ஷேத்திரம்

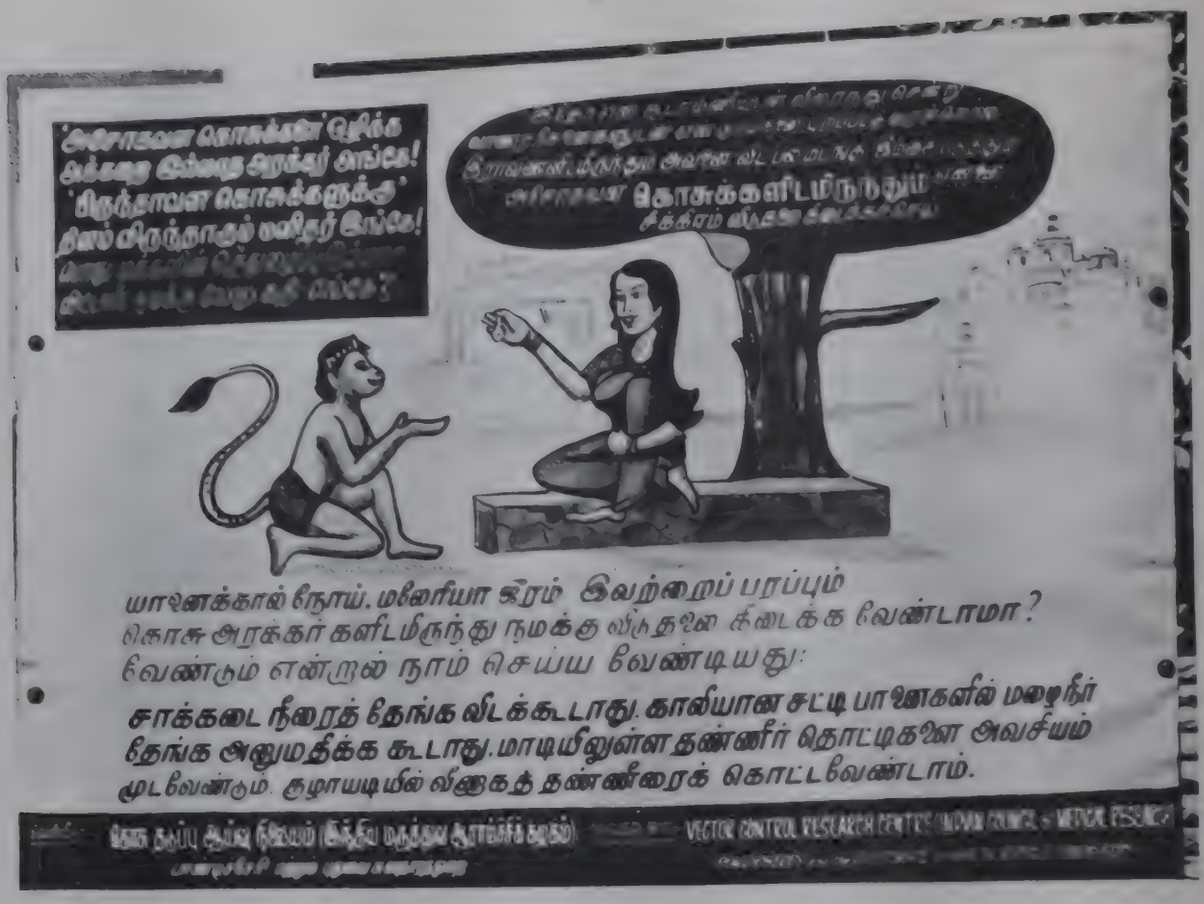
மருந்து தெளித்துக் கொசுக்களை ஒழிப்பது அரசாங்கத்தின் கடமை.
ஆனால் கொசுக்களை வளராமலே தடுப்பது நம் கையில் இருக்கிறது.
எங்கெல்லாம் அசுத்தநீர் தேங்குகிறதோ அங்கெல்லாம் கொசு
முட்டையிடும். அதைத் தடுக்க நாம் செய்யவேண்டியது!

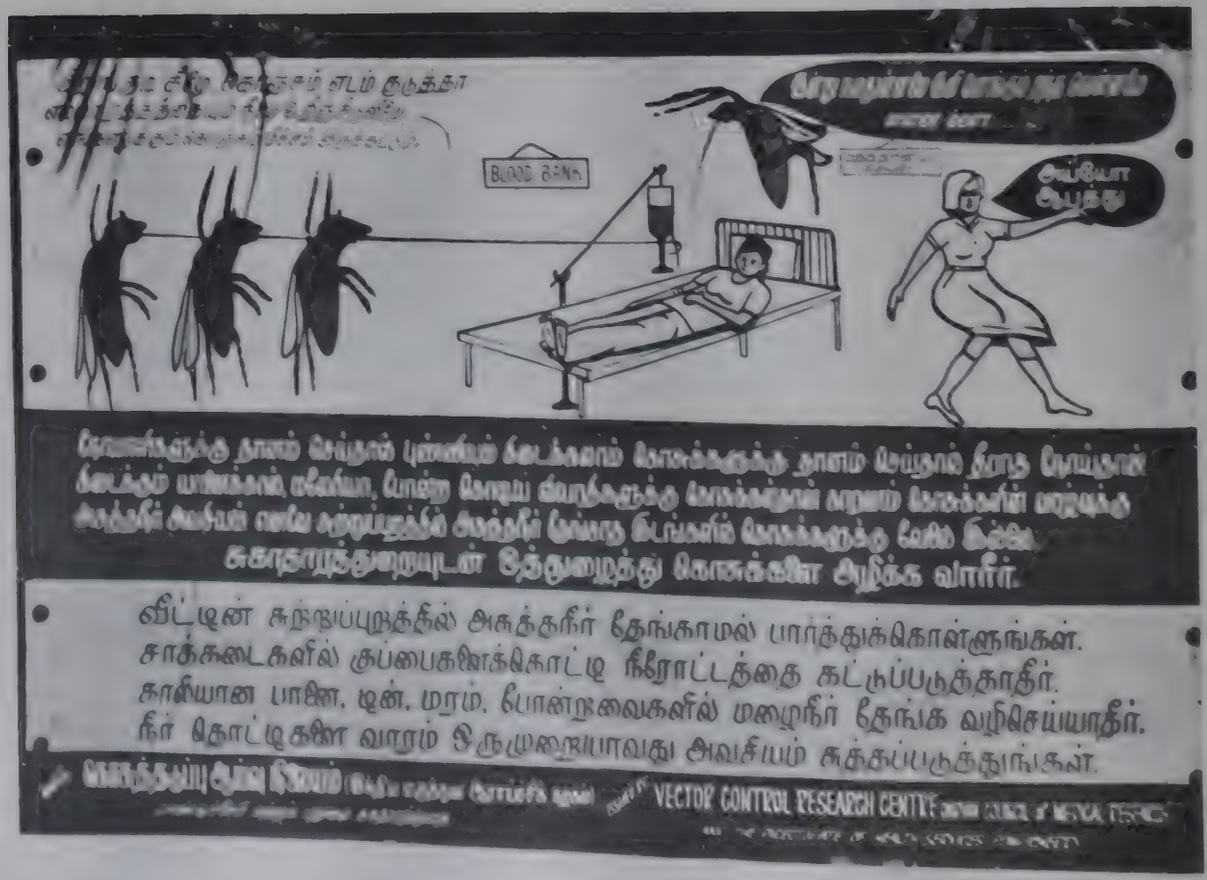
வீட்டுச் சாக்கடையில் தண்ணீர் தேங்கக்கூடாது.
வீட்டின் வெளியே காலியான மரம், டின், சட்டிப்பானைகளைப்
போடக்கூடாது. அப்படிப் போட்டால் மழைநீர் தேங்கும்.
வீட்டு மாடிகளில் உள்ள தண்ணீர்த் தொட்டிகளை அவசியம் மூடவேண்டும்.
குழாயடியில் தண்ணீரை வீணாகக் கொட்டவேண்டாம்.
தண்ணீர்த் தொட்டிகளை வாரம் ஒருமுறையாவது சுத்தப்படுத்துங்கள்.

வெளியீடு: கொசுத்தடுப்பு ஆய்வு நிலையம் (இந்திய மருத்துவ ஆராய்ச்சிக் கழகம்)
பாண்டிச்சேரி மற்றும் புதுவை சுகாதாரத்துறை

Hoarding No. 2

Fig. 16 & 17





Hoarding Nos. 3 & 4

Hoarding No. 3

The picture depicts an incident from another great epic "Ramayana", where Sita wife of Lord Rama was kidnapped by the demon Ravana and kept in Sri Lanka in captivity. Lord Rama sends Hanuman to Sita to convey the message that he is coming to rescue her. Sita tells Hanuman to inform Lord Rama to come with all might to rescue her as early as possible.

In this hoarding Sita says to Hanuman, that she is not at all bothered about the tortures given by the demon Ravana to her but, the tortures given by the mosquitoes in Sri Lanka is unbearable and asks Lord Rama to rescue her immediately from the mosquito torture. In this hoarding Sri Lanka represents Brindavan, a low lying colony in Pondicherry.

Filariasis and malaria are transmitted by mosquitoes, which can be prevented by preventing water stagnation, in all the possible places.

Hording No. 4

If you donate blood to the patients, you can get blessings, but if you donate blood to mosquitoes you will get only diseases like filariasis and malaria which can be prevented by keeping your environment clean without any water stagnation.

To prevent breeing of mosquitoes do the following :

Do not allow water to stagnate around your houses.

Do not throw any garbage in the drain and make it choked.

Empty the mud pots and containers at least once in a week.

Clean the water tanks at least once in a week.

Clean the water tanks a

Hoarding No. 5

Background : In India there is a system of giving dowry to the bridegroom by the bride's father. Even though the bride is beautiful and talented, she will be married only when her father offers dowry to the bridegroom.

In this hoarding, even though the bride's father is ready to offer lot of money as dowry, the bridegroom rejects the bride as she is affected by elephantiasis.

To prevent breeding of mosquitoes do the following things:

Do not allow water to stagnate in the drains.

Do not throw empty tins and pots outside or over the terrace and allow water to stagnate in it.

Do not allow water to leak from taps.

Hoarding No. 6

Saint Narada, of Hindu mythology, seeks the help of Lord Vishnu, to take another incarnation to come and kill the mosquitoes which are torturing the people of the world.

But Lord Vishnu says that people of the world are intelligent and they will safeguard themselves and eradicate the mosquitoes by environmental sanitation.

To prevent mosquito breeding we have to do the following things:

Help the health department by preventing stagnation of water in your surroundings.

Empty the containers and water tanks once in a week.

Fig. 18 & 19

Hoarding Nos. 5 & 6

Fig. 20 & 21

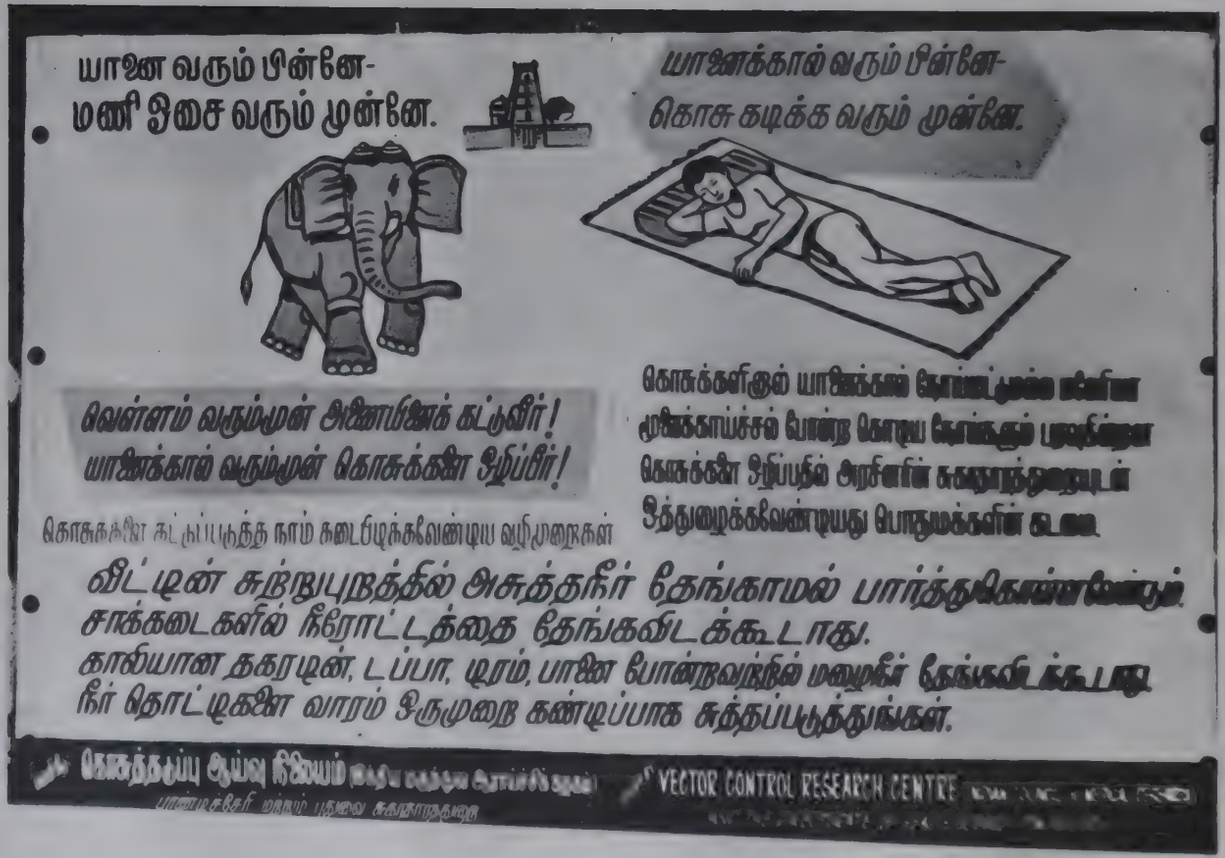
தேங்கிய நீரில் நமது சிவ்னேகள் காகிதப் படகுகள் விட்டு விளையாடுவதைப் பார்த்திருப்பீர்கள் ஆனால் அந்நீரின் உள்ளே கோழக்களுக்கான கொசுக்களின் முழுக்களும் நீந்தி விளையாடுகின்றன...

இன்று பத்து மீடும் மாதர்கள் கொசுக்கழக்கு ஆளாகி தானே காம் வீட்டி அவதிப்படுவதைத் தடுப்பது நம் கடமை!

சுந்நப்புற சுகாதாரத்திந்து அரசு மேற்கும் முயற்சிக்குப் பொது மக்களாகிய நாமும் ஒத்துழைப்பது அவசியம்!

வெளிஸ் நகர வீதிகளில் படுகுகள் மிதக்கும் காட்சி மிகரம்மியமானதுதான் புதுவை நகருக்கு அது அவசியந்தானு?

கொசுத்தடுப்பு ஆய்வு நிலையம் (மத்திய மருத்துவ ஆராய்ச்சி முகமை)
VECTOR CONTROL RESEARCH CENTRE (Indian Council of Medical Research)


யானை வரும் பின்னே-
மணி ஓசை வரும் முன்னே.
யானைக்கால் வரும் பின்னே-
கொசு கடிக்க வரும் முன்னே.
வெள்ளம் வரும்முன் அணைகளைக் கட்டுவீர்!
யானைக்கால் வரும்முன் கொசுக்களை ஒழிப்பீர்!
கொசுக்களினால் யானைக்கால் நோயைத் தவிர மலேரியா
மூளைக்காய்ச்சல் போன்ற கொடிய நோய்களும் பரவுகின்றன
கொசுக்களை ஒழிப்பதில் அரசின் சுகாதாரத்துறையுடன்
ஒத்துழைக்கவேண்டியது பொதுமக்களின் கடமை.
கொசுக்களைக் கட்டுப்படுத்த நாம் கடைபிடிக்கவேண்டிய வழிமுறைகள்
வீட்டின் சுற்றுபுறத்தில் அசுத்தநீர் தேங்காமல் பார்த்துகொள்ளவேண்டும்
சாக்கடைகளில் நீரோட்டத்தை தேங்கவிடக்கூடாது.
காலியான தகரடின், டப்பா, டிரம், பானை போன்றவற்றில் மழைநீர் தேங்கவிடக்கூடாது
நீர் தொட்டிகளை வாரம் ஒருமுறை கண்டிப்பாக சுத்தப்படுத்துங்கள்.
கொசுத்தடுப்பு ஆய்வு நிலையம்
VECTOR CONTROL RESEARCH CENTRE

Hoarding Nos. 7 & 8

Hoariding No. 7

This hoarding makes a comparison of the city of Venice which is a lake city and Venkata Nagar (a low lying colony) in Pondicherry.

Though sailing of boats in the lakes of Venice is a good scenary, sailing of paper boats in the low lying vacant plots with stagnant water in Venkata Nagar is very unhygienic and mosquitogenic.

The children who live near cesspools, will be bitten by mosquitoes breeding in the cespools and fall a victim of filariasis and malaria and so prevent mosquito breeding.

Hoarding No. 8

In Tamil there is a slogan which says that, the sound of the bell precedes an elephant; this is slightly modified to say that the mosquitoes comes first and filariasis comes later.

It is better to prevent mosquito breeding before filariasis comes as constructing a dam before flood.

Mosquito transmits filariasis, malaria and Japanese encephalitis.

To prevent mosquito breeding:

Do not allow water to stagnate in your surroundings.

Do not choke the drains by throwing garbage.

Do not allow water to accumulate in empty tins and containers.

Hoarding No. 9

"Feed the poor people and seek the blessings from God" is an Indian saying. But do not throw the leaves and garbage in the nearby drain and get cursed by the people and God.

Eradicate the mosquitoes and drive away filariasis.

By dumping leaves and garbage in the drains the drains get choked and breeds the vector of filariasis and malaria. So, dump the garbage in the dust bins.

Hoarding No. 10

In one of the famous epics, an elephant goes to a river to drink water and a crocodile gets hold of its leg. The elephant is unable to rescue itself from the crocodile, cries for the help of Lord Krishna, who immediately rushes to rescue the elephant.

In this hoarding it is said that even the God Lord Krishna is unable to help when you have elephantiasis. The crocodile is symbolically represented by a mosquito larvae and the elephant by a chronic filaria patient. So better prevent breeding of mosquitoes in your surroundings.

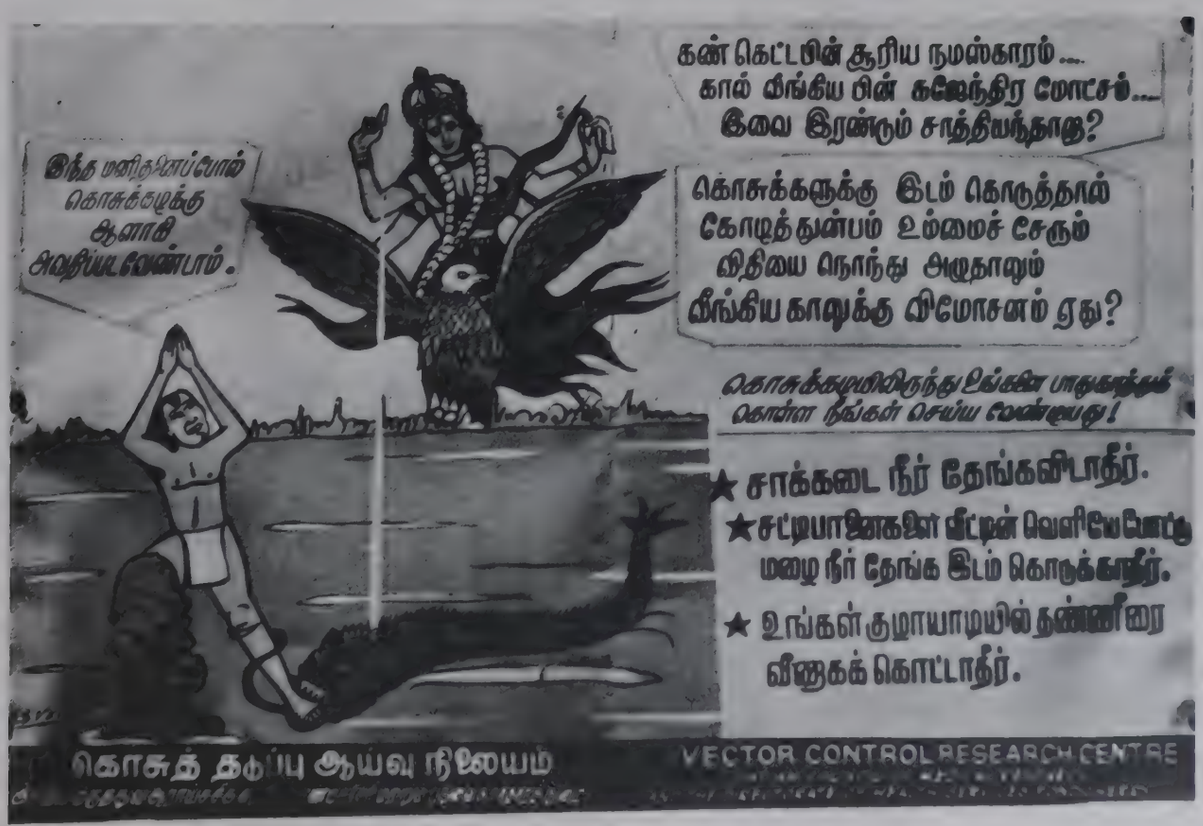
To prevent breeding:

Do not allow water to stagnate in drains.

Do not allow water to accumulate in empty containers.

Do not allow water to leak in your water taps.

Fig. 22 & 23



Hoarding Nos. 9 & 10

1 National Service Scheme, Tagore Arts College 2. Youth Forums; Subbaiah Manram, Kathirkamam 3. Tamizh Ilaignar Manram, Thelarshpet 4. All India Youth Federation, Subbaiah Nagar 5 Bharathidasan Youth Club, Keerapalayam 6. Y.M.C.A., Pondicherry 7. Youth wings of all Political Parties 8. All India Catholic University Federation (AICUF).

8 Health Education Programme were also initiated in the following schools :

1. S.D.A. School, Gandhi Nagar 2. Govt. High School, Gandhi Nagar 3. Govt. Primary School, Thelarshpet 4. Govt. High School, Kathirkamam 5. Govt. Higher Secondary School, Muthirapalayam 6. Govt. Primary School, Muthaliarpet 7. Govt. Primary School, Keerapalayam 8. Primary School, Nellithope 9. Primary School, Vanrapet 10. Primary School, Vambakeerapalayam 11. Primary School, Thengaithittu 12. Primary School, Murungapakkam 13. Primary School, Govindasalai 14. Primary School, Gundupalayam.

9 Advertisements : In a local weekly newspaper, slogans were published regularly for many months about the danger of mosquito nuisance remedial measures to be applied. Besides, many articles and letters to the editor were written in the various newspapers.

10 Opinion Survey : Since the launching of VCRC in 1975 in Pondicherry the centre is carrying out field oriented research work to control the breeding of mosquitoes in turn the incidence of diseases caused by mosquitoes. To obtain peoples' opinion about the VCRC programmes and also to welcome suggestions from the public an opinion survey was conducted through a questionnaire in April and May 1981.

The specific objectives of the survey are primarily to educate the people on :

1 The mosquitogenic conditions and diseases spread by mosquitoes,

2 Their responsibilities in controlling the mosquitoes,

3 Control methods adopted by the VCRC,

4 Extending co-operation of the public to the VCRC spraying teams, and to

5 Elicit their suggestions for further improvement in the working of the VCRC project. This is very necessary to incorporate the views of the public that community participation would become a reality.

Questionnaires were issued to 1200 households spread over the study area. Only 700 responded. An analysis of the data collected showed the following.

1. Awareness of mosquitogenic conditions and diseases spread by mosquitoes

80% of the respondents were aware of the diseases spread by mosquitoes; Nine percent were of the view that the 'Filariasis' is due to the curse of God; Seven percent were of the opinion that this disease is spread by flies and four percent stated that polluted water causes the disease.

2. Responsibilities in controlling the mosquitoes

62% of the respondents were of the view that both the Government and public are responsible for controlling the mosquitoes. 38% of the people were of the opinion that it is the duty of the Health Department of the Govt.

3. Awareness of the work of VCRC

94% of the respondents appreciated the work of the VCRC teams in spraying operations and in cleaning the drains and to tell the people about the diseases caused by mosquitoes, while six per cent stated that the VCRC staff are visiting their area only for cleaning and spraying.

4 Root cause for mosquito nuisance

68% of the respondents were of the view that the public themselves are responsible for the mosquito nuisance, while 12% stated that the Municipality is responsible for the present situation. Another 12%

blamed PWD being the cause for spreading mosquitoes. Six per cent of the respondents stated that the VCRC is "releasing mosquitoes" and another two per cent blamed the politicians for the present muddle.

5. Opinions and suggestions given by the respondents

Regarding their opinions and suggestions to control the mosquitoes 65% of the respondents were of the opinion that Health Education should be given more importance, so that the people's participation in the programme can be expected to a maximum extent.

The following are some of the opinions given by the respondents

1 Since flies also act as vectors for spreading many diseases steps should be taken up to educate the mothers and children not to buy any eatables sold by the street vendors.

2. Dumping garbage in the drains leads to stagnation of water and leads ultimately to mosquito breeding. To rectify this, the people should be educated so that they will keep their surroundings clean and will also keep their drains free from stagnation.

3. Educating the public through films and other audio - visual aids like slides, pictures etc., will give better results. If health education is included as a subject in schools, it will give good result as the younger generation will come to realize the impact of the dreaded diseases and also the immediate need for better sanitation and environment.

4 Some people were of the opinion that filariasis is a curse of God on human beings. This kind of superstitious beliefs should be rooted out completely. Women were more superstitious then men. They felt that it is better to talk to the womenfolk and change their attitude towards these dangerous diseases and to seek their cooperation in keeping their surroundings clean.

5 Constitution of advisory committees with leaders from various sections of the community for general planning and implementation of the health education programme and also to generate interest and willing participation in the public health programmes.

6 Many people felt that while the majority of the public understand the importance of sanitation and strive hard to maintain it, it is not always possible because a few high officials and few politicians with vested interests turn a blind eye to the problems.

7 Seventeen per cent of the respondents desired more cleaning and spraying. According to them spraying one day in a week is not sufficient and they suggested that spraying should be done twice a week. Eight percent desired better cooperation between the Health Department and VCRC for better implementation of the programme. The co-operation of Government Departments like Municipality, Town Planning, Public Works Department, Department of Health and Family Welfare Services can be sought to achieve the goal. Most of the respondents suggested to place dust bins at frequent intervals in the streets and the people may be persuaded to make use of them. Garbage should be removed atleast on alternative days by the municipality workers and the drainage should also be cleaned. At present the Municipality workers are not frequently visiting the streets. Even if they visit they are not doing their duty properly and demand money for spraying also. Representation from the public are not looked into by the Government officials. So there should be on the spot supervision and checking to ensure efficient work output. Representation from the people should be given weightage and necessary action should be taken up as early as possible. Many complained about the present unsatisfactory drainage system. Proper drainage system is very essential to avoid stagnation of water on the roads and streets. In many localities the gradient in the drains is not proper. Effluents from

houses are led into vacant plots nearby. With proper planning and supervision the net work of drainage can be connected to the sea and then only stagnation of water can be prevented. Some stressed the importance of the periodic visits of Health Team (Mobile Clinic) to the field and hence the routine health care is available at door steps. The mass should be educated on the importance of immunization of children at specified times.

Any programme directed towards community welfare will not work without the essential element of community awareness and community involvement in the planning and implementation of such a programme. In community - based health programmes the basic attitude is ' working with the community ' and ' not giving to the community '.

The VCRC was horrified to find that many highly placed bureaucrats, whose primary job it is to maintain proper gradient in drains and enforce environmental sanitation, were totally ignorant of the conditions. While the uneducated public are willing to co-operate, these bureaucrats always raised objections which discouraged other people in cooperating with the mosquito control programme, making one suspect that some of these officials must be having a vested interest in maintaining the status quo.

ANNEXURE 1

Curriculum for Opinion Leaders Orientation Programme

Objective :

1. Educate Opinion Leaders to identify mosquitogenic problems in their locality and finding ways and means to solve these.

2. To motivate and guide the community to work for better environment and develop a habit of living in clean envirnoment.

3. To make them aware of the responsibilities of the different departments to solve problems of mosquitogenic conditions and insist on their rights as tax - payers.

Curriculum for training

Disease caused due to :

1	Improper personal hygiene	(Worm infection-defaecating everywhere) (leprosy - spitting everywhere)
2	Mosquitoes	(Malaria, Filaria, Japanese encephalities)
3	House flies	(Cholera, dysentry and other enteric disorders)
4	Disease process of filaria and epidemiology	(Large number of bites)
5	Role of mosquitoes in the transmission of filariasis	
6	Mosquito life cycle and housefly breeding places	
7	Practical demonstration of breeding places	
8	How to combat vector borne diseases?	

How to combat diseases caused by poor sanitary conditions :

No amount of insecticides is going to help, due to several well known reasons (like resistance of mosquitoes to insecticides, non - availability and high cost of insecticides, the inevitable operational inefficiency in pesticide application, lack of public co-operation etc., etc.,). The only solution is source reduction through environmental sanitation, which will be of a permanent nature.

But no control method will succeed if there is no community participation. The community means both official and non-official. Several agencies are responsible for the present state of affairs-Municipality, P. W. D., Housing Board, Town Planning etc., and the people themselves. A High Power Meeting was held some time back to discuss this problem. It was felt that there are several sections in the Pondicherry Municipalities Act, 1973, which if enforced. would solve the problem to a large extent. The relevant sections are Nos. 249, 270, 323, 470 & 475 and other connected rules given in the Annexure (Annexure 2).

You can help to solve the problem by following ways :

1 It has been observed that people clean their premises and dump all their solid garbage in the nearby drain which in turn chockes the drain creating water stagnation. As a result heavy mosquito breeding occurs. Don't dump solid garbage in drains. Garbage should be dumped in dust bins provided by the civic authorities.

2 People keeping cattle should not throw any solid and waste material into the drain.

3 Stagnant water bodies should be emptied as early as possible. Water should not be allowed to stand in any place for more than 5 days. Don't allow water to stagnate or let out in other's area.

4 Small pits in and around houses should be closed

5 Empty tins, containers, small mud pots, coconut shell. old tyres, etc., accumulates rain water which should be destroyed or emptied once a week

6 Releasing fish in wells can control mosquito breeding.

7 Co-operate with Governmental agencies to serve you better.

8 Strictly follow all civic laws.

9 Take personal protection like mosquito nets, wearing full sleeves, sleeping under a fan, using mosquito coil, repellants etc.

ANNEXURE 2

Provisions of Pondicherry Municipal Act 1973 and Town & Country Plan Act 1969 which will enable Mosquito Control Operations

Pondicherry Municipalities Act

Section 249 :

Prohibition against allowing outflow of filth: No owner or occupier of any premises shall allow the water from any sink, drain, latrine or stable, or any other filth to flow out of such premises to any portion of a street except a drain or a cesspool or to flow out of such premises in such a manner as to cause unavoidable nuisance by the soakage of the said water or filth into the walls or ground at the side of a drain forming a portion of a street.

Section 270 :

Power of the Commissioner to order work to be carried out or to carry it out himself in default.

Section 323 :

Filling in of pools etc. which are a nuisance.

Section 345 :

Licences for places in which animals are kept : The owner or occupier of any stable, veterinary infirmary stand shed yard or other place in which quadrupeds are kept or taken in for purposes of profit shall apply to the commissioner for a licence not less than thirty and not more than nintey days before the opening of such place, or before the commencement of the year for which the licence is sought to be renewed as the case may be.

Section 346 :

Powers of control over stables, cattle-sheds and cow – houses.

Section 470 :

Execution of the work by occupier in default of the owner.

If the owner of any building or land fails to execute any work which he is required to execute under the provisions of this Act or of any rules, byelaw regulation or order made thereunder, the occupier of such building or land may, with the previous approval of the Commissioner execute the said work and shall be entitled to recover from the owner the reasonable expenses incurred in the execution there of and may deduct the amount there of from the rent accrued or accruing the owner.

6. STATE GOVERNMENTS' ROLE IN THE PROJECT :

Intensive ecological, entomological and parasitological studies over a period of five years preceeded the preparation of the project report and a master plan for the control of mosquitoes in Pondicherry. The report was discussed at great length by the Scientific Advisory Committee which was attended among others by the representative of the National Filaria Control Programme (Dr. R. G. Roy) and by the Director of Health and Family Welfare Services, Govt. of Pondicherry. The project master plan as recommended by the Scientific Advisory Committee was submitted to the Govt. of Pondicherry which was later accepted by the then Lt. Governor of Pondicherry for implementation. who had also offered the cooperation of the State Government. This cooperation was reiterated by the Chief Minister of Govt. of Pondicherry, on January 9, 1981 when the project was formally inaugurated, who also announced that the Govt. of Pondicherry will spend a matching sum of Rs. 50 lakhs for the implementation of the project.

Right from the beginning, the VCRC aimed at involving the various departments of the state Government with a view to involve them actively in a project which aims at permanent improvement in the living conditions of the people. The Prime Minister of India, in her message at the time of inauguration stated as follows :

"I am glad that the Indian Council of Medical Research and the Govt. of Pondicherry have joined to develop an integrated strategy for mosquito control in Pondicherry. Studies have shown that in January 9 million mosquitoes emerge every day in Pondicherry alone. The number can be reduced only by improving and eliminating the drains, cesspools and pits where mosquitoes breed. This needs the active involvement of all people who must be encouraged to take keen interest in environmental cleanliness in every street and locality"

The wishes of the Prime Minister can be fulfilled only if health is not viewed in isolation and our goal of health for all by the year 2000 A. D. can be achieved only if all the departments cooperate wholeheartedly.

In spite of a lot of goodwill and help ful attitude shown by the Chief Secretary and heads of other departments, not much headway could be made in implementing the numerous decisions taken by the committees appointed by the Govt. of Pondi-

cherry. There is certainly some change in the attitude of different department but a sence of urgency is sadly lacking. There are numerous constraints in the implementation of the decisions, but it is not for the VCRC to find fault with any department. We earnestly hope that there will be progress, though slow, so that at the end of the five year period, the different departments would coordinate their activities in such a manner that the gains achieved will be sustained.

High Level Committee

The various recommendations made on and the action taken on the High Level Committee decisions are listed below :

Date	Recommendations	Action taken
4-9-1980	1. LAD asked to immediately undertake the deweeding and desilting in the major canals before 31-10-1980 and report the action taken to the Chief Secretary	No action has been taken in the Uppar Canal execpt some desilting work near Balaji Theatre. Terminal end of Grand Canal not desilted so far
	2. PWD asked to extend the canal right upto the sea and also arrange to have the mouth of the canal frequently open	This also was done only twice and in a manner that the mouth was closed immediately by sand bar during high tides
	3. PWD asked to find out a perma nent solution to the Thengathittu lagoon	Detailed scheme said to have been submitted for approval.
	4. Explore the possibility of constructing wells at the terminal end	Not done
	5. Director (H & F. W.) and Director, VCRC, were also asked to consult WHO/Counsultant to suggest a permanent solution	Consulted and suggestion were put forward before High Level committee.
	6. Senior Town Planner & LAD were asked to send circulars highlighting the existing provision of Pondicherry Municipality. LAD was advised to instruct the municipalities and communes to issue notice and take appropriate action against violation	Law found inadequate and time consuming.
	7. Director, Health & Family welfare Services was asked to strengthen Health education	Health education is carried out regularly through various media.
	8. Director, VCRC, was asked to bring to the notice of Health Secretary, Chief Secretary, any problems which need the attention of the Government.	Being done regularly.

Date	Recommendations	Action Taken
24-12-1980	1. The Chief Secretary directed PWD Director to construct three wells near light house and pump the water directly into the sea. This work must be completed before 31st March 1981	Not done
	2. The Chief Secretary directed that the Director, PWD, must assume the responsibility for the maintenance. The Director, PWD, was asked to first have the entire stretch cleaned and then post sufficient number of staff on a permanent basis	Not yet completed
	3. Municipal Commissioner asked to regularly clean and desilt the canals which are under his jurisdiction	Partially done
	4. Municipal Commissioner asked to discuss with Law Secretary enforcement of civic act	Law found inadequate
	5. The Chief Secretary asked PWD to complete the construction work in Kamaraj Salai drain in proper manner, clear and hand over to the Municipality	Completed in part
4-4-1981	1. Health Minister, after visiting the problem areas suggested that a master plan should be prepared	Master plan prepared Not yet approved
	2. All the blind ends of the drains and blind canals should be completed as early as possible	Not done (Land acquisition pending)
	3. Uppar Canal should be desilted and banks of the Uppar Canal should be kept free from huts and social forestry department could be approached for planting eucalyptus / casuarina	Not completely done
	4. Vacant plots should be acquired by Government to create some fear among the people who hold these land for speculative purpose and not yield to our request for filling up of plots	No action
	5. Chief Minister instructed that a development scheme may be prepared for the entire area so that it could be developed with basic amenities	Plans prepared by Senior Town Planner but no action

Operational Committee

Recommendations and the action taken on the Operational Committee decisions are listed below :

Date	Recommendations	Action taken
15-10-1980	1. Vector Control Research Centre and Filaria Officer were asked to cite specific cases of insanitary condition	VCRC has brought many specific cases of insanitary condition and repeatedly doing so Filaria Control Programme brought once
	2. Proper disposal of effluents from textile mills should be maintained and LAD will enforce the proper disposal of the waste in such a manner that they do not contribute to mosquitogenic conditions	No action taken
	3. Regarding Thengathittu lagoon, it was suggested that Fisheries Department should be approached to develop this area into a lido or a lake where edible fishes such as Tilapia should be released. It was also suggested that Veerampattinam canal should be opened to the sea by the PWD atleast once in a fortnight	No action taken
	4. Town Planning Department should not permit any new construction which have no provision for proper waste water disposal	No action taken
	5. Since in Bouleward area drains are completely covered with slabs, mosquitoes breed through openings and exposed manholes. PWD was requested to look into this matter and report at the next meeting.	No action taken
15-11-1980	6. Senior Town Planner will prepare estimates and make suitable proposal for the areas where drainage facilities are inadequate	No action taken
	7. Municipal Commissioner & Executive Engineer, PWD, will jointly inspect with VCRC officials to rectify the situation	Jointly inspected and recommendations made

Date	Recommendations	Action taken
	8. The Municipality, PWD and Senior Town Planner may lay the drains take corrective steps to regrade the drains etc, wherever it is technically/ administratively feasible	No action
	VCRC will spray insecticide in areas where immediate solution is technically/ administratively not feasible	VCRC is regularly spraying
	9. Chairman stated that Public Health Act is coming up before forthcoming assembly	No action
	10. Regarding Railway campus, Diretcor VCRC, undertook to write to the appropriate railway authority	Problem was referred to Railway Board
	11. Disposal system of drainage water in Venkata Nagar area to be rectifed before the 30th November 1981	Not done VCRC has cut open the temporary channel to connect it with nearest canal
	12. Drain in Villianur Road was found to be incomplete in the tail end	No action taken
	13. Drain parallel to Cuddalore Road is incomplete	Completed
23-1-1981	14. Construction of well at the terminal end of Uppar Canal	Estimates were prepared and sent for approval
	15. Regarding desilting of Uppar Canal	Estimates were prepared and sent for approval
	16. Tail end of Grand Canal conld't be cleaned and Municipal Commissioner wanted that PWD should evacuate the people from the bank	No action taken
21-2-1981	17. Cleaning and desilting of the Uppar Canal will start from 23-2-1981. For this financial sanction has been obtained	Work started but not yet completed
	18. Closing of kutcha drain on the side of Cuddalore road will be done by PWD	Completed
	19. Regrading L-shaped drains in the Lenin Street and roadside drain on the northside of Pulian Chalai Street	No action taken

Date	Recommendations	Action taken
	20. Cement lining of Venkata Nagar main drain	No action taken
	21. Extending of Villianur roadside drain and connect it with Uppar canal to be done by PWD	No action taken
	22. Complete lining of Villianur road-side drain	No action taken
	23. Cleaning of Kamaraj Salai drain to be done by PWD	Cleaned
	24. Regrading L-shaped drain in Nallandu Maistry street to be done by Pondicherry Municipality	No action taken
	25. Construction of drain in Railway campus to be done by Municipality	Completed
	26. Cleaning and deweeding of Kosapalayam & Saram kutcha drain	Completed
	27. Mill street drain was found to be incomplete and improperly constructed. PWD Director agreed to rectify the problem	No action
	28. Villianur roadside drain is also incomplete due to land acquisition	No action
	29. Closing of unused wells in Pethuchettipet	People objected to closing this
	30. Completion of roadside drains in Karuvadikuppam	Not yet completed
	31. Connecting Murungapakkam drain to Ariankuppam river	No action
16-5-1981	32. Grand Canal will be desilted by Pondicherry Municipality by 18th May 1981	Completed
	33. Regular desilting of listed drains will be done once a month	Done partly
	34. Grand Canal is broken in different parts by water works to be repaired	Not Done

Date	Recommendations	Action taken
	35. Vacant plot on both sides of the Natesan Nagar by pass road-accumulating water and PWD was asked to find out some solution	No action
	36. Building materials blocking the drain Director, PWD, was asked to remove such obstacles	Completed
	37. Municipalities were asked to issue notices to the cattleshed owners which causes public health problem	Action taken partially
	38. Regarding vacant plots, Director, PWD stated that Housing Board will acquire the area if it is big enough	No action
27-2-1981	39. It was recommended that the construction in Grand Canal to absorb the sewage water in underground system should be removed because the diameter of the pipe is so small that it was not serving the purpose	Completed
	40. Replacement of slabs in the Bussy street will be done by PWD	Completed
	41. Kutcha drain opposite to Liberty Hotel was creating mosquitogenic conditions. Municipalities were asked to find alternative solution	No action

Various problems that are referred individually and the action taken so far by the various departments are detailed below

S. No.	Nature of the problem	Date of first ref.	Action taken so far	Date of completion	Authority responsible for work
1.	Desilting of Uppar Canal	4—9—80	Entire stretch was not cleaned thoroughly so far except in certain places	—	P. W. D.
2.	Desilting of Grand Canal	4—9—80	Initially it was cleaned once and further maintenance was not done properly	—	Pondicherry Municipality
3.	Desilting and cleaning of Petit Canal	4—9—80	Properly maintained by frequent cleaning and desilting	—	,,
4.	Solathandavankuppam canal extn. and cleaning	4—9—80	The canal has been extended and maintained cleanly	—	Pondicherry Municipality
5.	Kurichikuppam canal desilting and cleaning	4—9—80	Cleaning and desilting being done periodically	—	,,
6.	Govindasalai canal desilting, cleaning and providing slabs	4—9—80	Cleaning and desilting done and slabs were also provided on the top	4—4—81	,,
7.	Thengathittu lagoon	4—9—80	In spite of numerous suggestions for temporary solution no action has been taken so far	—	P. W. D.
8.	Enforcement of the existing public health act and inclusion of new provisions in the Public Health Act	4—9—80	Existing provision for proper maintenance of cattle sheds are being enforced. But new provisions were not provided so far	—	Pondicherry & Ozhukarai Municipality
9.	Health education to public	4—9—80	Health education is being done by putting hoardings, posters and pamphlets – continually being done to educate the people by meeting them as and when possible	—	V. C. R. C.

S. No.	Nature of the problem	Date of first ref.	Action taken so far	Date of completion	Authority responsible for work
10.	Filling up of vacant plots	25-10-80	a. Town and Country Planning Department was asked to issue notices to vacant plot owners through the concerned Municipalities. But there was no response from the municipalities concerned as there is no provision for penalising the erring citizens. Pending for want of approval for the master plan	—	Pondicherry, Ozhukarai Municipalities as well as Town & Country Planning Dept.
			b. Special request are being sent to all the vacant plot owners requesting them to fill up or to take up construction to prevent the mosquitogenic condition		V. C. R. C.
11.	Replacement of broken slabs over the drains within the Bouleward	15-10-80	New slabs have been provided to all the broken places	15-10-81	P. W. D.
12.	Filling of the cesspool in railway campus and construction of drainage canal	15-11-80	a. Drainage canal has been constructed and connected to the near by Uppar Canal	12-8-81	P. W. D.
			b. Filling up of the remaining low-lying area has not been taken up	—	Railway authorities
13.	Construction of drainage canal in Venkata Nagar	15-11-80	No action has been taken	—	Ozhukarai Commune Panchayat
14.	Effluent discharge from the textile mills	15-10-80	No action has been taken	—	Local Administration Dept.

S. No.	Nature of the problem	Date of first ref.	Action taken so far	Date of completion	Authority responsible for work
15.	Slaughter house effluent in Orleanpet	15-11-80	Proper disposal arrangements were made	10-12-80	Pondicherry Municipality
16.	Desilting and cleaning of Kamaraj salai U-drain	15-11-80	Complete desilting and cleaning was done	21-3-81	P. W. D.
17.	Closing of kutcha drain in Cuddalore road	17-11-80	The kutcha drain was completely closed	10-4-81	P. W. D.
18.	Regrading of L-drain in Lenin street	24-10-80	No action has been taken	—	P. W. D.
19.	Connecting of drain running in front of Thirvalluvar bus stand to Uppar Canal	17-11-80	No action taken	—	P. W. D.
20.	Valudavur roadside drain need to be regraded and connected to nearest drainage canal	13-2-81	No action taken	—	P. W. D.
21.	Regrading and connecting of Nallandu Maistry St. drain	21-2-81	Regraded and connected to the nearest drain	—	Pondicherry Municipality
22.	Cleaning and desilting of Mill street drain in Mudaliarpet	17-11-80	Cleaning and desilting was attended to partially	30-3-81	"
23.	Completion of drain ni Vellala street	17-11-80	No action	—	Town and Country Planning Dept.
24.	Closing of unused well in Pethuchettipet	17-11-80	When the authorities went for closing the well the people of that locality objected and it was left as such	10-4-81	P.W.D.

S. No.	Nature of the problem	Date of first ref.	Action taken so far	Date of completion	Authority responsible for work
25.	Providing an exit to the Karuvadikuppam drain	18-2-80	In spite of repeated inspections and pressere from this end no action has so far been taken to give an exit to the dead end drain and this serves as a trench latrine to the people of that area	10-4-81	Pondicherry Municipality
26.	Connecting Murungapakkam drain to Ariankuppam river	13-2-81	In spite of repeated inspections, no action has been taken so far by the Mudaliarpet Asst. Engineer. But a temporary connection has been given by providing a kutcha drain by the FCP	—	Pondicherry/ Mudaliarpet Municipality
27.	Cleaning and deweeding of Kosapalayam, Saram kutcha drain	24-10-80	Cleaning and deweeding done by the Executive Engineer IV	25-2-81	P.W.D.
28.	Cement lining of Ayanar Koil drain and giving a connection near Ayanar Nagar	15-11-80	The work is being done in three phases and the work is found to be satisfactory. But the connection near Ayanar Nagar is yet to be given and the drain near that is yet to be lined	—	P.W.D.
29.	Cement lining of Mullai Nagar drain and providing an exit	17-11-80	Cement lined and proper exit was also provided	20-1-81	Pondicherry Municipality
30.	Closing of the septic tank in the public latrine in Mill Street	17-11-80	Slabs has been provided and the septic tank was closed	17-2-81	,,

S. No.	Nature of the problem	Date of first ref.	Action taken so far	Date of completion	Authority responsible for work
31.	Closing of the coir pits and filling up of a swamp in Duprayapet	4-9-80	No action was taken up by either PWD or Municipality. So after repeated requests, the possibility of filling was studied by VCRC and the whole area was filled up with sand and available garbage, with the help of a Bulldozer and the work was completed by September 1981	Sep. 81	P.W.D. & Pondicherry Municipality
32.	Cement lining of Cuddalore roadside kutcha drain	13-2-81	The kutcha drain was cement lined and connected to the Mill street drain	20-4-81	P. W. D.
33.	Keerapalayam roadside drain extension and cement lining	13-2-81	No action	—	P. W. D.
34.	Repairs in Kompakkam drain	28-1-81	Repairs were attended to by the Mudaliarpet Municipality	20-2-81	—
35.	Cement lining of Pappamma canal	16-5-81	No action	—	P. W. D.
36.	Water stagnation in front of Liberty Hotel and inside the Railway campus	23-2-81	No action so far by the authorities concerned. But VCRC has connected the water accumulation to the nearest Kolas Nagar drain and the entire stretch is being cleaned regularly	—	P. W. D. & Pondicherry Municipality
37.	Stagnation of water opposite to Mudaliarpet Mairie	23-2-81	No action taken so far eventhough the stagnation is in front of the Mairie itself.	—	Mudaliarpet Municipality

S. No.	Nature of the problem	Date of first ref.	Action taken so far	Date of completion	Authority responsible for work
38.	Drainage block in Bankarai street, Keerapalayam	9—6—81	Blockage removed	12-6-81	P. W. D.
39.	Regrading of newly constructed drains in Mariamman Nagar or Karamanikuppam	9—6—81	No action taken	—	P. W. D.
40.	Regrading of U-drain in south bouleward	9—6—81	No action taken	—	P.W.D.
41.	Drinking water leakage near Bus stand/Botanical garden	17-6-81	Leakage closed	8-10-81	P.W.D.
42.	Blockage in the new U-drain opp. to Viveganandа Nagar	17-6-81	No action so far	—	P. W. D.
43.	Septic tank leakage in Sithankudisai public latrine	23-6-81	No action	—	Ozhukarai Commune Panchayat

7. LARVAL EVALUATION

An effective programme of evaluating the impact of control operations is essential if the programme has to succeed. Therefore, a concurrent assessment of breeding was made to make any improvement or modification of the programme, if necessary. To determine the choice of method all the breeding places in the study area were marked and detailed maps prepared. Since source reduction is one of the major plan of the programme, the total surface area available was evaluated at six montly intervals to find out the impact of source reduction. Actual surface area available in different forms were also evaluated on half - yearly basis.

1. *Fixed stations :*

Though control operations were carried out by N. F. C. P. in zones I. II & VII evaluation is carried out in all zones by independent teams of VCRC. For breeding survey the total study area was sub-divided into 40 blocks and they were surveyed once a week. Survey programme was fixed in such a way that the area to be covered by the control team is surveyed one day in advance and the information passed on to the control team for further action.

The different areas in each zone which are being surveyed regularly are given below:

Vector control operation under Govt. of Pondicherry.	Vector control operation under V. C. R. C.
ZONE I	ZONE III
Bouleward I Bouleward II	Kottakuppam Karuvadikuppam Lawspet Tagore Nagar Saram Brindavan Venkata Nagar Rainbow Nagar Kumaragurupallam
ZONE II	Zone IV
V. O. C. Nagar Kurichikuppam Valakulam Muthialpet	Govindasalai Kosapalayam Mohan Nagar Thilagar Nagar Orleanpet Kennedy Nagar Ellapillaichavadi Pettayanchattiram

Vector control operation under Govt. of Pondicherry	Vector control operation under V. C. R. C.
ZONE VII	ZONE V
Ariankuppam	Natesan Nagar Nellithope Mudaliarpet Vanrapet Vambakeerapalayam Kolas Nagar Uppalam Thengathittu Nainarmandapam Keerapalayam
	ZONE VI
	Reddiarpalayam Subbaiah Nagar Murungapakkam Kadirkamam Jipmer Thattanchavadi

From December 81, onwards larval evaluation is being carried out in 60 stations and these will be reported in the next report.

Breeding places like cess pits, cess pools, cement tanks, vacant plots & drains were surveyed every week. For covering all the 40 fixed stations, four teams each headed by a Research Assistant and one Field Assistant were employed. The work schedule is given in the following table. Breeding reports are handed over daily to control team for taking preventive action.

TEAMS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
I	Brindavan Saram	Keerapalayam	Mohan Nagar Thilagar Nagar Ellapillaichavadi	Murungapakkam Reddiarpalayam	Govindasalai Kolas Nagar

TEAMS	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
II	Nellithope Savariarpet Uppalam	V.O.C.Nagar Valakulam	Thengathittu Pattaiancha- thiram	Subbaiah Nagar Thattanchavadi Nainarmandapam	Vanrapet Vambakeera- palayam
III	Orleanpet Kennedy Nagar	Tagore Nagar Bouleward II	Karuvadi- kuppam	Muthialpet	Bouleward I Ariankuppam
IV	Mudaliarpet	Kosapalayam Pillaithottam	Lawspet Kuruchi- kuppam	Kottakuppam Jipmer Kadirkamam	Venkata Nagar Rainbow Nagar Kumaraguru- pallam

2. Irrigation / Sewage canals

There are a few canals which pass through many localities. To survey each drain a special team was deputed to monitor the breeding status. The drains covered by this team were :

1. Cuddalore roadside drains
2. Mill street drain
3. Kosapalayam drain
4. Grand Canal
5. Port office drain
6. Uppar Canal
7. Govindasalai U - drain
8. Petite Canal
9. Nellithope U – shaped drain
10. Karuvadikuppam U – shaped drain
11. Reddiarpalayam U - shaped drain
12. Ariankuppam U - drains
13. Lawspet - U-shaped drains
14. Pakkumudayanpet Canal
15. Vivekananda Nagar Canal
16. Murungapakkam U – drain

3. Well survey

To evaluate the efficacy of biological control agents (fish) all the wells in the study area were marked and surveyed quarterly for mosquito breeding, presence of fish, etc., The survey results were imme-

diately handed over to biological control team which in turn undertook necessary action. Two teams, each headed by one Research Assistant and assisted by one field worker are deployed for this purpose. In some wells where both fish and mosquito breeding are observed, fish population density are estimated to find out the level at which the predator and the prey strike the balance. Water samples were analysed and the presence of other insect fauna were studied in such cases.

4. In all the breeding places the following parameters were also collected to correlate the immature density with adult density and to keep an estimate on total emergence.

1. Correlation between Dipper sample and Absolute Population (field)
2. Immature survival (field)
3. Instar duration (field)
4. Hatchability

5. Sampling procedures in different habitats

Breeding in cess pits, cess pools and vacant plots is assessed by dipper sampling. Number of dips to be taken in these habitats depended on the size (For one metre diameter 3 dips, 2 metre-5 dips, 3 metre-7 dips. 4 metre-9 dips and so on). In vacant polts and in drains sequential sampling i.e. one dip per 10 metre distance at periphery is taken.

The average number of larvae & pupae per dip and percentage of dips positive were then calculated.

Bucket sampling was used in wells and the average number of larvae & pupae for bucket sample was measured.

Results

The extent of *Culex quinquefasciatus* breeding was evaluated in different breeding habitats. All the breeding places were marked in maps. For operational convenience the breeding habitats were classified as follows.

1. Storm water canals (which are fed by other drains carrying sewage water)
2. Drains (U-shaped and L-shaped)
3. Cess pits / Cement tanks
4. Cess pools / vacant plots
5. Wells

The total surface area of different type of breeding habitats are summarized below:

Total breeding surface area (In sq. metres)

Season	Storm water canal	Drains U-shaped	Drains L-shaped	Drains kutcha	Cess pits/ Cement Tanks	Cesspool/ vacant plots	Wells
DRY	176112.57	5035.62	23012.45	3029.00	1463.14	46793.62	1772.15
WET	176112.57	5035.62	35006.35	4030.00	3768.00	184793.63	2112.96

Fortnightly survey of all the breeding places in the fixed stations was carried out upto June and the results summarized. There was a drastic reduction in breeding in different habitats and very good control was maintained for several months. During the month of July the operational programme was suspended due to labour problem and work restarted in August. The frequency of survey was increased from fortnightly to weekly intervals from August. The data indicate effective control of breeding in different habitats in VCRC control areas. However the total surface area increased tremendously after the rains and many incomplete civic works resulted in increase of total surface area breeding.

The data also showed that the surface area breeding in drains in Zones I & II, which are under routine control operations carried out by Govt. of Pondicherry, has always been at a high level.

One year data of the larval evaluation from December '80 to December '81 is appended in Tables 18 to 29 and figs 27 and 28 for cess pits, cess pools, drains, stormwater canals and wells. Data on fish (*Gambusia affinis*) release in wells and vacant plots are appended in Table 30.

TABLE 18.

Breeding status of *Culex quinquefasciatus* in Cess-pits (% +ve for pupae, December 1980 — March 1981)

(No. +ve-No. surveyed)

ZONE	December		January		February		March	
	Fortnight							
	I	II	I	II	I	II	I	II
Zone I	—	—	30.0 (3-10)	10.0 (1-10)	30.0 (3-10)	7.14 (1-14)	Nil (0-13)	Nil (0-13)
Zone II	26.32 (10-38)	4.44 (2-45)	5.36 (3-56)	6.89 (4-58)	3.51 (2-57)	2.02 (3-148)	1.02 (2-195)	0.52 (1-190)
Zone III	11.90 (5-42)	3.70 (2-54)	1.22 (1-82)	2.7 (2-74)	1.75 (2-114)	1.55 (2-129)	0.74 (1-135)	2.94 (4-136)
Zone IV	Nil (0-25)	Nil (0-32)	2.15 (2-93)	3.77 (2-53)	Nil (0-52)	Nil (0-120)	Nil (0-140)	Nil (0-154)
Zone V	9.68 (6-62)	4.30 (4-93)	1.65 (2-121)	0.88 (1-114)	0.59 (1-169)	2.35 (6-255)	3.73 (10-268)	1.33 (4-299)
Zone VI	26.32 (5-19)	23.81 (5-21)	Not sampled	19.05 (4-21)	4.35 (2-46)	1.44 (1-69)	Nil (0-75)	Nil (0-72)
Check Zone	60.0 (3-5)	40.0 (2-5)	14.29 (1-7)	14.29 (1-7)	38.46 (5-13)	16.66 (3-18)	21.73 (5-23)	4.34 (1-23)

TABLE 19.

Breeding status of *Culex quinquefasciatus* in Cess-pits (% +ve for pupae, April 1981—August 1981)

(No. +ve—No. surveyed)

ZONE	April		May		June		August			
	Fortnight						Week			
	I	II	I	II	I	II	I	II	III	IV
Zone I	14.28 (2-14)	14.28 (2-14)	Nil (0-14)	Nil (0-14)	11.76 (2–17)	0 (0-16)	21.43 (3-14)	18.75 (3–16)	6.3 (1-16)	28.57 (4–14)
Zone II	1.57 (3-190)	1.05 (2-190)	0.52 (1-190)	2.13 (4-187)	2.63 (5-190)	1.55 (3-194)	6.9 (13-186)	7.66 (16-209)	14.75 (27-183)	15.93 (29-182)
Zone III	0.72 (1-139)	1.61 (2-144)	0.74 (1-135)	1.47 (2-136)	0 (0-146)	0.68 (1-148)	3.1 (4-129)	1.3 (2-153)	2.45 (4-163)	0 (0-175)
Zone IV	0.69 (0-145)	Nil (0-152)	0.67 (1-148)	1.29 (2-155)	1.26 (2-168)	0 (0-159)	3.59 (6–167)	2.25 (4-178)	1.15 (2-173)	3.24 (6-185)
Zone V	0.32 (1-308)	Nil (0-308)	0.33 (1-299)	0.99 (3-301)	0 (0-298)	0.95 (3-316)	5.26 (12-228)	3.25 (8-246)	1.65 (5–303)	0.95 (3-316)
Zone VI	4.00 (3-75)	Nil (0-74)	Nil (0–73)	Nil (0-74)	1.33 (1-75)	0 (0-80)	9.1 (6.66)	2.7 (2-74)	2.29 (2-87)	3.53 (3–85)
Check Zone	Nil (1-23)	Nil (0-20)	Nil (0-21)	Nil (0-17)	Nil (0-17)	18.18 (2-11)	9.1 (1–11)	9.09 (1–11)	40.0 (4-10)	20.0 (2-10)

Breeding status of *Culex quinquefasciatus* in (

(No.

ZONE		September					
	ZONE	I	II	III	IV	I	II
Zone I	Zone I	—	—	—	—	—	—
Zone II	Zone II	11.9 (1-9)	6.66 (1-15)	11.6 (2-17)	5.5 (1-18)	0 (0-18)	—
Zone III	Zone III	0 (0-88)	1.2 (1-83)	0 (0-95)	0 (0-114)	0 (0-86)	2.22 (2-90)
Zone IV	Zone IV	0 (0-62)	0 (0-75)	0 (0-84)	0 (0-88)	0 (0-77)	1.25 (1-80)
Zone V	Zone V	0 (0-62)	2.17 (1-46)	3.92 (2-51)	0 (0-156)	0 (0-155)	0 (0-54)
Zone VI	Zone VI	0 (0-11)	0 (0-11)	0 (0-12)	16.66 (2-12)	9.09 (1-11)	6.25 (1-16)
Check Zone	Check Zone	0 (0-4)	0 (0-4)	0 (0-3)	100 (1-1)	5.0 (1-2)	0 (0-9)

TABLE 21

Cess - pools (% +ve for pupae, September 1981 - December 1981)
+ve – No. surveyed)

October			November				December	
WEEK								
III	IV	V	I	II	III	IV	I	II
—	—	—	—	—	—	—	—	—
11.77 (2-17)	0 (0-19)	0 (0-24)	0 (0-4)	0 (0-19)	4.76 (1-21)	0 (2-21)	11.53 (3-26)	10.53 (2-19)
1.14 (1-88)	1.14 (1-88)	1.1 (1-91)	0 (0-87)	0 (0-105)	0 (0-105)	0.95 (1-105)	0 (0-102)	1-43 (2–140)
0 (0-79)	0 (0–72)	4.82 (4-83)	0 (0-85)	1.25 (1-80)	0 (0-85)	0 (0-78)	1.23 (1-81)	0 (0–129)
0 (0-50)	0 (0-49)	0 (0-59)	0 (0-57)	0 (0-63)	0 (0.52)	0 (0-47)	1.81 (1-55)	0 (0-59)
25.0 (2-8)	0 (0-25)	6.67 (1–15)	0 (0-10)	0 (0-10)	0 (0-10)	0 (0-10)	0 (0-10)	2.47 (2-81)
0 (0-2)	0 (0·3)	14.29 (1–7)	0 (0–6)	0 (0-3)	0 (0-4)	0 (0-4)	0 (0-6)	0 (0-7)

TABLE 22.

Breeding status of *Culex quinquefasciatus* in Cess-pools (% +ve for pupae, December 1980 — March 1981)

[No. +ve—No. surveyed]

ZONE	December		January		February		March	
	Fortnight							
	I	II	I	II	I	II	I	II
Zone I	—	—	—	—	—	—	—	—
Zone II	15.38 [2-13]	7.69 [1-13]	Nil [0-14]	Nil [0-15]	Nil [0-14]	12.50 [1-8]	6.66 [1-15]	Nil [0-9]
Zone III	Nil [0-15]	9.09 [1-11]	10.81 [4-37]	3.23 [1-31]	Nil [0-27]	1.21 [1-86]	Nil [0-79]	Nil [0-83]
Zone IV	4.55 [1-22]	4.55 [1-22]	4.88 [2-41]	3.85 [1-26]	5.41 [2-37]	Nil [0-37]	3.12 [1-32]	2.43 [1-41]
Zone V	4.35 [1-23]	3.23 [1-31]	2.50 [1-40]	Nil [0-37]	2.38 [1-42]	1.92 [1-52]	2.63 [1-38]	Nil [0-38]
Zone VI	50.0 [3-6]	50.0 [3-6]	Not sampled	40.0 [2-5]	Nil [0-10]	Nil [0-9]	Nil [0-9]	Nil [0-9]
Check Zone	Nil [0-1]	50.0 [1-2]	Nil [0-2]	33.33 [1-3]	Nil [0-4]	Nil [0-3]	Nil [0-3]	Nil [0-4]

TABLE 23.

Breeding status of *Culex quinquefasciatus* in Cess-pools (% +ve for pupae, April 1981—August 1981)

(No. +ve—No. surveyed)

ZONE	April		May		June		August			
	Fortnight						Week			
	I	II	I	II	I	II	I	II	III	IV
Zone I	—	—	—	—	—	—	—	—	—	—
Zone II	20.00 (1-5)	Nil (0-10)	Nil (0-10)	Nil (0-12)	Nil (0-10)	16.67 (2-12)	Nil (0-13)	Nil (0-14)	Nil (0-5)	4.54 (1-22)
Zone III	Nil (0-83)	Nil (0-79)	Nil (0-81)	Nil (0-83)	Nil (0-81)	Nil (0-88)	1.08 (1-90)	Nil (0-94)	Nil (0-63)	Nil (0-77)
Zone IV	Nil (0-39)	Nil (0-38)	Nil (0-36)	Nil (0-34)	Nil (0-40)	Nil (0-43)	5.1 (2-39)	Nil (0-23)	2.22 (1-45)	1.78 (1-56)
Zone V	Nil (0-45)	Nil (0-45)	Nil (0-46)	Nil (0-53)	Nil (0-37)	Nil (0-54)	3.03 (1-33)	Nil (0-27)	2.94 (1-34)	Nil (0-47)
Zone VI	Nil (0-10)	Nil (0-9)	Nil (0-9)	Nil (0-10)	Nil (0-11)	Nil (0-11)	12.5 (1-8)	Nil (0-10)	Nil (0-7)	8.33 (1-12)
Check Zone	Nil (0-3)	Nil (0-4)	Nil (0-4)	Nil (0-4)	Nil (0-4)	Nil (0-4)	Nil (0-2)	Nil (0-4)	Nil (0-2)	10.0 (1-10)

TABLE 24.

Breeding status of *Culex quinquefasciatus* in drains (December 1980—March 1981)

(No. of pupae/dip)

ZONE	December		January		February		March	
	Fortnight							
	I	II	I	II	I	II	I	II
Zone I	1.47	27.53	2.39	1.20	1.19	1.95	1.31	1.04
Zone II	0.63	0.25	0.48	0.56	0.23	0.27	0.85	0.005
Zone III	0.07	0.16	Nil	Nil	0.02	Nil	Nil	3.34
Zone IV	0.13	2.38	0.02	0.02	1.50	10.54	0.02	0.38
Zone V	0.06	0 60	0.19	0.05	0.02	0.55	0.15	Nil
Zone VI	1.42	12.34	Nil	1.23	0.03	0.04	0.04	Nil
Check Zone	0.85	1.31	3.98	4.82	2.97	7.63	1.37	5.72

TABLE 25.

Breeding status of *Culex quinquefasciatus* in drains (April 1981—August 1981)
(No. of pupae/dip.)

	April		May		June		August			
ZONE	Fortnight						Week			
	I	II	I	II	I	II	I	II	III	IV
Zone I	0.76	0.40	0.33	1.00	1.25	0.53	3.95	1.56	0.07	0.59
Zone II	0.008	0.005	Nil	Nil	0.31	0.25	0.08	0.13	0.20	0.06
Zone III	0.01	Nil	Nil	Nil	0	0	0.49	0	0	0
Zone IV	0.05	Nil	0.40	Nil	0	0	0.12	0.02	0	0.07
Zone V	0.01	0.23	0.13	Nil	0.04	0.01	0.31	0.004	0.06	0.05
Zone VI	0.03	0.82	Nil	Nil	0	0	0.86	0.71	0.23	0
Check Zone	0.83	1.35	0.30	0.55	1.06	0.86	0.88	2.13	36.4	0.11

TABLE 26.

Breeding status of *Culex quinquefasciatus* in drains (September 1981—December 1981)

(No. of pupae/dip.)

ZONE	September				October					November			December		
	Week														
	I	II	III	IV	I	II	III	IV	V	I	II	III	IV	I	II
Zone I	0.005	0.49	0.85	1.58	2.21	—	0.52	1.12	0	0.092	1.87	0.015	1.77	0.06	0.48
Zone II	0.23	0.09	0.17	0.33	1.19	—	0.05	0.05	0	0.035	0.045	0.84	0 15	0.005	0
Zone III	0	0	0.02	0	0	0.007	0	0.003	0.004	0.05	0	0.11	0.01	0.52	0
Zone IV	0	0.004	0.004	0.001	0.01	0.001	0.03	0.03	0	0.104	0.11	0.01	0.15	0	0.05
Zone V	0.12	0.01	0.02	0.03	0.05	0.016	0.28	0.30	1.02	0.002	0.03	0.009	0.02	0.016	0.076
Zone VI	0.24	0	0.08	0.14	0.56	0.01	0.38	0.4	0	0.086	0.08	0.09	0.15	0	0.12
Check Zone	0.13	1.05	0.27	3.0	14.04	4.97	4.86	2.72	0.72	0.04	1.7	0.13	0.48	0.76	9.07

TABLE 27.

Surface area (m^2) breeding *Culex quinquefasciatus* (pupae) in major drains
Actual breeding surface area—total surface area (% area +ve)

Drain	MARCH		APRIL		MAY		June	
	I	II	I	II	I	II	I	II
1) Grand canal	0-2380	0-5396	8.9-4385	20.2-8935	6.5-7623	8.8-6924	31.4-6273	18.7-8116
	—	—	[0 2]	[0 23]	[0.09]	[0.13]	[0.5]	[0.23]
2) Uppar canal	0-9262	0-3405	0-16702	0-10825	0-51255	0-5167	0-1170	0-7058
	—	—	—	—	—	—	—	—
3) Petit canal	0-213	—	0-412	0-445	0-748	0-641	0-924	0-725
	—	—	—	—	—	—	—	—
4) Pakkamudayanpet drain	168.5-2233	1.4-1455	0-1667	0-2921	0-2871	0-2151	0-2068	0-2230
	[7.55]	[0.10]	—	—	—	—	—	—
5) Karuvadikuppam &	0-351	0-308	0-379	0-303	0-439	0-462	0.5-412	0.5-469
Lawspet	—	—	—	—	—	—	[0.12]	[0.11]
6) Govindasalai	0-449	5.4-351	0-428	0-393	0-405	0-372	0-297	0 153
	—	[1.54]	—	—	—	—	—	—
7) Reddiarpalayam	—	—	0·81	0-240	0-393	0.5-403	0-435	2.7-225
	—	—	—	—	—	[0.2]	—	[1.2]
8) Vivekananda Nagar	0-285	0-245	0-388	0-165	0-357	1.2-356	3 9–407	17.6-573
	—	—	—	—	—	[0.34]	[0.96]	[0.07]
9) Nellithope	0-121	4.2-540	0-144	16.2-591	0.8-989	0-573	2.4-745	0.9-978
	—	[0.78]	—	[3.74]	[0.08]	—	[0.32]	[0-10]
10) Mill street drain	—	3.2-771	51.9-987	3.4-975	6.7-1286	0-632	0-346	0-406
	—	[0-42]	[5.26]	[0.35]	[0.52]	—	—	—
11) Murungapakkam	0-119	0-154	0-188	0-205	0-224	0-231	0-219	0-261
	—	—	—	—	—	—	—	—
12) Kosapalayam	0-192	0.2-102	—	0-265	0-272	—	0-270	0-265
(U-drain)	—	[0.19]	—	—	—	—	—	—
13) Kosapalayam	0-943	1.1-99	18.7-1623	0-72	0-1590	11.7-1546	0–470	0–1209
(Kutcha drain)	—	[1.1]	[1.15]	—	—	[0-76]	—	—
14) Venkata Nagar	0-1280	0-1280	0-760	0-687	0-620	0-561	0-557	0-579
(Kutcha drain)	—	—	—	—	—	—	—	—

Fig. 24

Evaluation of immature stages in cess pits

Fig. 25

Larval evaluation-sampling and counting

Fig. 26

Immature survival and mark release recapture experiments

Fig. 27

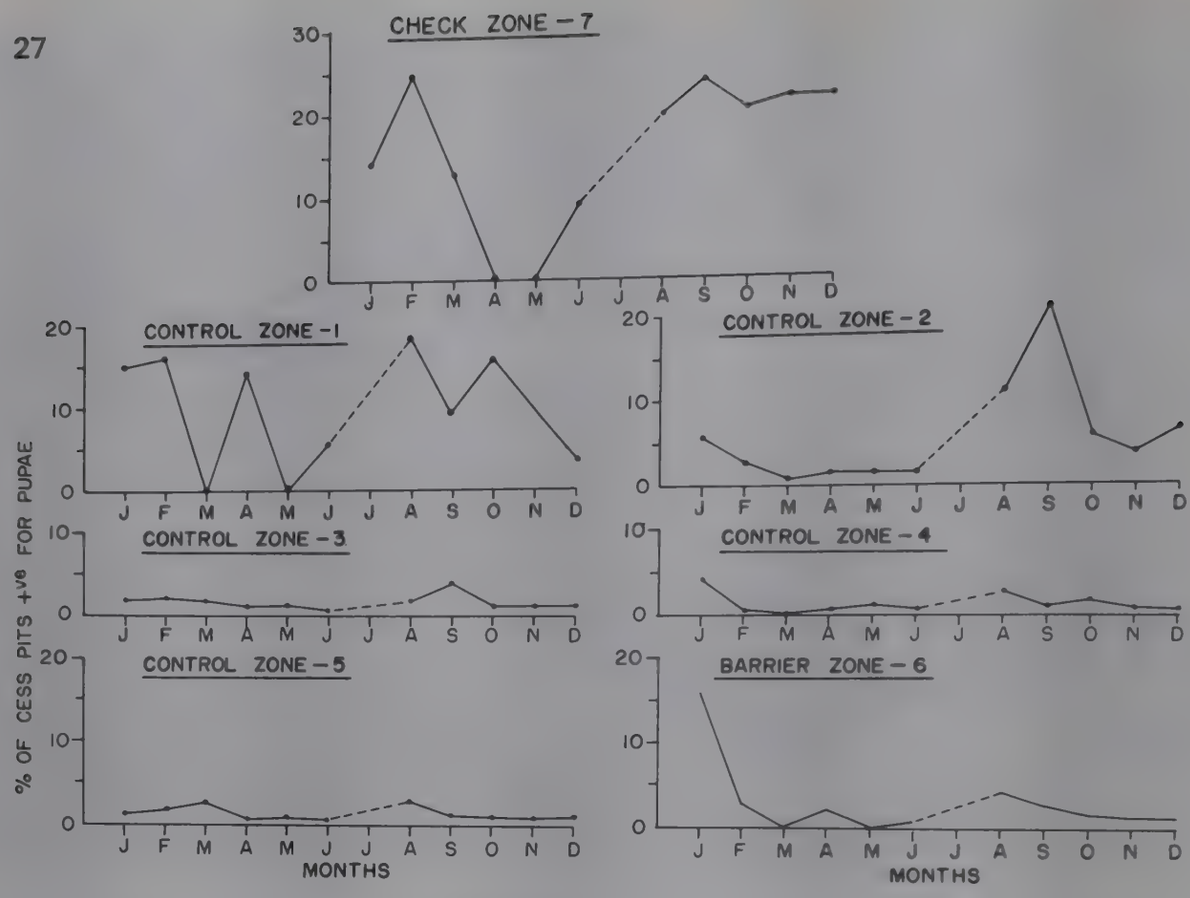

CHECK ZONE – 7
CONTROL ZONE – 1
CONTROL ZONE – 2
CONTROL ZONE – 3
CONTROL ZONE – 4
CONTROL ZONE – 5
BARRIER ZONE – 6
% OF CESS PITS +VE FOR PUPAE
J F M A M J J A S O N D
MONTHS

Fig. 28

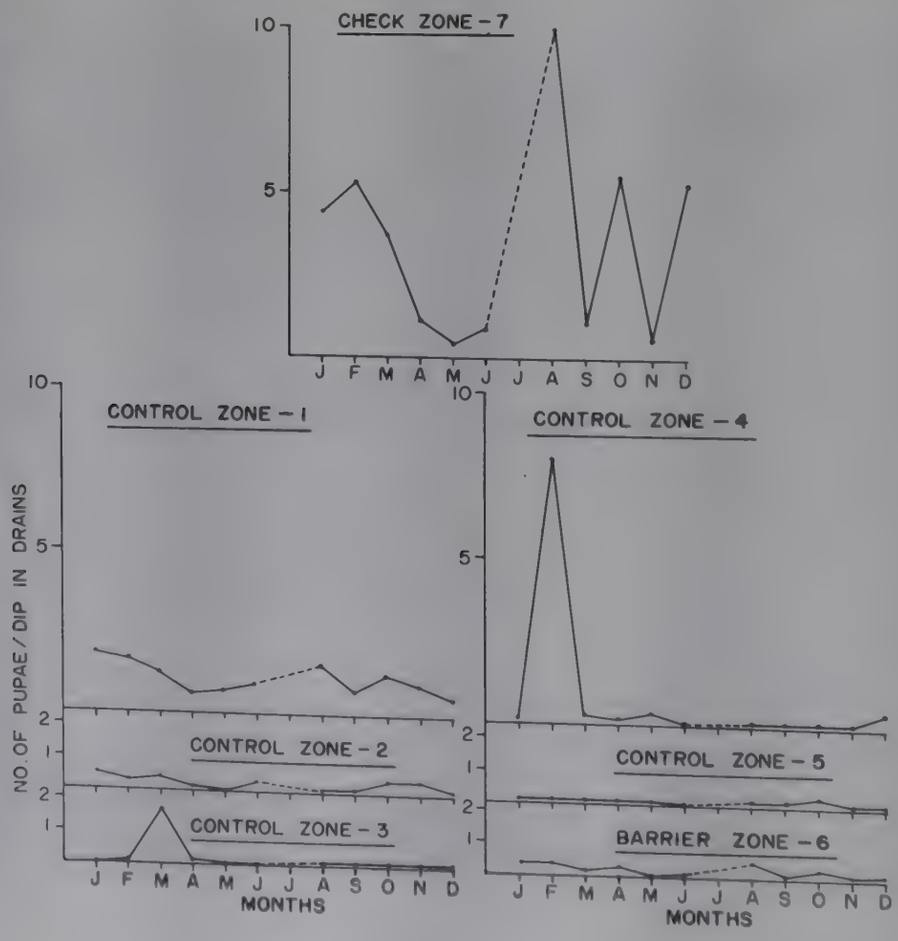

CHECK ZONE – 7
CONTROL ZONE – 1
CONTROL ZONE – 4
CONTROL ZONE – 2
CONTROL ZONE – 5
CONTROL ZONE – 3
BARRIER ZONE – 6
NO. OF PUPAE / DIP IN DRAINS
J F M A M J J A S O N D
MONTHS

Fig. 27 Percentage of cess pits positive for pupae
Fig. 28 Number of pupae per dip in drains

Drain	Round	Zone	Total Wells surveyed	Used	Unused	Dry	Total + ve wells
*1. Grand Canal		3	646	479	87	80	61
2. Uppar Canal	March 81	4	380	310	64	6	33
3. Petit Canal	I to	5	857	738	90	29	82
4. Packumudaiyanp drain	May 81	6	326	151	107	68	76
5. Karuvadikuppam Lawspet							
6. Govindasalai		3	689	483	102	104	54
7. Reddiarpalayam	June 81	4	390	312	66	12	62
8. Vivekananda Na	II to	5	1001	828	125	48	91
9. Nellithope	September 81	6	340	165	101	74	47
10. Mill street drain							
11. Murungapakkam		*1	944	888	51	5	57
12. Kosapalayam U-drain	October 81	*2	183	163	20	—	19
13. Kosapalayam (Kutcha drain)	to	*3	269	152	88	29	25
14. Venkata Ngara (Kutcha drain)	III Still	*4	355	301	54	—	8
15. Aniankuppam (U - drain)	in	*5	704	634	48	22	11
16. Ariankuppam (kutcha drain)	Progress	*6	40	19	7	14	3

TABLE 29

urvey - first, second and third rounds

Positive used wells		Positive unused		*Culex quinque fasciatus*			No. +ve For other species	*Culex quinque fasciatus*		Other Species	
No.	%	No.	%	No. + ve	+ve for pupae	% + ve		Average No. of L/d	Average No. of P/d	Average No. of L/d	Average No. of P/d
2	0.35	29	5.12	31	18	5.48	39	1.84	0.29	3.59	0.12
2	0.53	24	6.42	26	11	6.95	18	10.90	0.41	1.70	0.17
4	0.48	43	5.14	47	24	5.60	58	9.29	0.31	0.99	0.04
2	0.78	53	20.54	55	25	21.32	56	59.98	1.63	13.14	0.77
2	0.35	39	6.77	41	17	7.12	15	16.87	0.8	0.93	0.03
4	1.06	25	6.61	29	11	7.67	33	18.49	0.27	1.94	0.27
4	0.42	40	4.2	44	22	4.62	59	12.01	0.66	1.44	0.11
1	0.38	34	12.78	35	9	13.16	25	6.62	0.40	5.84	0.12
—	—	6	0.64	6	4	0.64	51	1.14	0.08	1.56	0.01
1	0.55	9	4.99	10	5	5.46	9	5.27	0.27	5.27	0.31
—	—	21	8.75	21	7	8.75	7	12.18	1.38	0.45	0.01
1	0.28	6	1.69	7	3	1.94	3	4.87	0.86	0.97	0.09
—	—	7	1.03	7	5	1.03	4	3.37	0.26	0.07	—
—	—	3	11.54	3	1	11.54	—	7.69	0. 4	—	—

TABLE 30.

Fish release *Gambusia affinis* in wells and vacant plots in different zones

Zone	Total No. of wells	Fish release (wells)	Fish release (vacant plots)
3	689	680	68
4	484	484	45
5	1001	985	—
6	401	401	20

8. ENTOMOLOGICAL AND PARASITOLOGICAL EVALUATION

In an operation of this kind where source reduction is given very high priority, the results can be perceptible only after a few years. The density of mosquitoes will fluctuate not only according to the efficiency of control operations but also due to climatological factors. The seasonal fluctuations in the density as measured helps primarily in giving information to control teams so that they can take more vigourous antilarval measures. Such trends will be compared on a year to year basis, locality wise, and the final assessment of the impact of the control measures will be based only on reducing the transmission potential to a level at which no new microfilaria carriers can be detected.

Epidemiology of filariasis is such that the impact of the vector control measures on the microfiaria rates could be assessed only after 5 years. Therefore concurrent entomological and parasitological data are being collected. From this data risk of infection is calculated. For calculating risk of infection relative abundance of vectors, biting rate, parity status, vector infection and infectivity rates are being collected regularly. Though an efficient larval evaluation programme is inbuilt in the programme, it does't give a clear cut picture of the impact of control measures on the transmission. The larval evaluation rather helps in improving efficiency of operational programme by pinpointing the breeding sites missed by the control teams so that prompt remedial measures can be taken.

Resting density

Fortnightly collections were made from 18 fixed catching stations and per/man hour density is summarized in Table 31. On the suggestion of Scientific Advisory Committee, the check area was changed from Ariankuppam to Cuddalore in August. Data show that except in few areas adult resting density was found to be below that of the check zone. Secondly in each station, resting density was brought back to very low level from January to June. High density areas like V. O. C. Nagar, Muthialpet and Kuruchikuppam are under the control of the State Filariasis Control Programme. Subbaiah Nagar, another section showing persistently higher density, is due to heavy breeding in JIPMER campus which is supposed to be controlled by JIPMER

sanitary staff themselves. But this campus is one of the heaviest breeding areas in Pondicherry. Parity status of resting mosquitoes collected were determined and it was found that the proportion of parous/nulliparous is very high (Table 32) which indicates fewer emergence. However there are variations from fortnight fo fortnight and whenever more nulliparous were found in a particular station the results were communicated to larval evaluation as well as control teams to look for missing breeding sites. Infection and infectivity rate were also determined and summarized in Table 33 and 34. Infection rates fluctuated from time to time and as expected since we are not undertaking any measures to reduce the microfilaria load in the population by chemotherapy. However infectivity rate is found to be very low and in some months when it was found higher, the density was very low.

Biting density

Weekly biting collections from six stations are summarized in Table 35. There is a clear cut reduction in the biting density in comparison to previous year for the corresponding period (Figs. 30, 31 & 32). The mosquitoes collected from man biting were dissected for parity status, infection and infectivity rate and the data are summarized in Tables 36, 37, and 38. As stated earlier vector infection, infectivity rate, remained unchanged and fluctuating. Since the control programme is neither directed towards the mf carriers nor towards the adult, no dramatic reduction in this rate is expected.

Risk of infection

Based on these data risk of infection was calculated by using the methods of De Meillon *et al* and found it is very low (Table 39). The risk of infection compared to previous year was also found to be low (Table 40) except for the month of August which is probably due to temporary stoppage of control programme.

Prevalence of other non-biting mosquitoes

Other mosquitoes found biting in all night collections are summarized in Table 41. Out of 10 other species found biting man only two species viz., *C. vishnui group* and *Armigeres* were found perennial whereas other species biting man were seasonal.

Night human biting collections made in Mudaliarpet area clearly revealed a picture of the fluctuations in the different mosquito species biting man seasonally. Biting density of *Culex tritaeniorhynchus* showed a five fold increase during September & October at which time there was an outbreak of encephalitis epidemic in Pondicherry and neighbouring districts of Tamil Nadu viz., South Arcot & North Arcot. This data on biting collections can act as a forewarning system on the other mosquito diseases like encephalitis & malaria. The data also revealed that only two species of mosquitoes i.e. *Culex quinquefasciatus* and *Armegeres subalbatus* appear to be perennial and the rest are seasonal in its prevalence.

Sl. No.	Fixed Resti Catching Sta
1	V.O.C. Nagar
2	Muthialpet
3	Kurichikuppa
4	Saram
5	Karuvadikupp
6	Jeevanandapu
7	Govindasalai
8	Kosapalayam
9	Vambakeerapa
10	Vanrapet
11	Nellithope
12	Thengaithitt
13	Mudaliarpet
14	Keerapalaya
15	Subbaiah Nag
16	Reddiyarpala
17	Nainarmandap
18	Ariyankuppa (Check Zone)

* From Augu

Infection rate of house-resting population of Culex quinquefasciatu

Sl. No.	Fixed Resting Catching Stations	Jan.		Feb.		Mar.		Apr.	
		I	II	I	II	I	II	I	II
1	V.O.C. Nagar	17.6	15.6	11.6	23.2	12.0	25.0	18.2	14
2	Muthialpet	9.0	27.0	24.0	19.0	43.2	34.4	28.0	18
3	Kuruchikuppam	9.4	6.5	10.7	10.0	13.6	18.2	14.3	14
4	Saram	24.0	19.1	33.3	20.0	29.0	27.0	27.5	25
5	Karuvadikuppam	13.6	36.4	16.7	30.8	21.4	8.0	0	
6	Jeevanandapuram	16.1	12.2	5.8	17.8	21.6	38.4	4.1	16
7	Govindasalai	18.4	9.0	18.0	16.0	15.0	14.9	11.8	20
8	Kosapalayam	19.7	16.7	3.8	15.5	16.9	13.3	11.4	9
9	Vambakeerapalayam	-	8.0	19.0	11.5	10.0	3.2	12.5	25
10	Vanarapet	-	20.8	7.0	8.5	16.0	5.8	13.0	
11	Nellithope	9.0	5.0	13.0	11.0	9.4	8.3	12.0	16
12	Thengaithittu	4.8	2.0	20.5	20.0	18.0	21.7	33.3	
13	Mudaliarpet	14.8	19.0	10.5	12.5	6.3	9.7	0	14
14	Keerapalayam	5.9	9.0	10.0	8.0	13.8	19.2	5.6	5
15	Subbaiah Nagar	7.1	15.0	8.0	10.0	12.5	8.0	19.0	7
16	Reddiyarpalayam	1.6	13.2	8.1	3.8	10.0	25.0	0	
17	Nainarmandapam	9.8	10.3	8.3	0	5.9	7.7	17.5	3
18	Ariyankuppam (Check Zone)	9.5	6.0	10.5	13.0	9.4	21.1	14.3	

Sl. No.	Fixed R Catchir tions
1	V.O.C. Na
2	Muthialpe
3	Kuruchiku
4	Saram
5	Karuvadik
6	Jeevanand
7	Govindasa
8	Kosapalay
9	Vambakeer
10	Vanarapet
11	Nellithop
12	Thengaith
13	Mudaliarp
14	Keerapala
15	Subbaiah
16	Reddiyarp
17	Nainarman
18	Ariankupp (Check Zo

Infectivity rate of house resting population of Culex qui

Sl. No.	Fixed Resting Catching Stations	Jan.		Feb.		Mar.		Apr.	
		I	II	I	II	I	II	I	
1	V.O.C. Nagar	1.4	1.6	2.9	9.0	0	0	9.0	
2	Muthialpet	2.0	1.0	6.0	0	2.3	2.2	1.0	1
3	Kuruchikuppam	1.2	0	0	7.5	0	9.1	0	
4	Saram	8.6	2.4	2.9	2.2	0	1.4	0	
5	Karuvadikuppam	0	9.0	0	0	0	0	0	
6	Jeevanandapuram	0	0	0	3.6	0	0	0	
7	Govindasalai	4.1	0	0	1.0	0	2.2	1.1	
8	Kosapalayam	1.4	2.4	0	1.4	0	0	0	
9	Vambakeerapalayam	-	1.0	0	0	1.7	0	1.6	
10	Vanarapet	-	2.0	0	0	8.0	2.0	2.2	
11	Nellithope	0	0	0	0	3.0	0	0	
12	Thengaithittu	0	0	2.6	0	0	4.3	0	
13	Mudaliarpet	3.7	9.5	5.3	0	0	0	0	
14	Keerapalayam	1.2	1.0	0	0	0.6	2.0	0	
15	Subbaiah Nagar	0	0	2.0	1.4	1.3	0.6	0	
16	Reddiyarpalayam	0	0	0	3.8	1.7	0	0	
17	Nainarmandapam	0	3.5	0	0	0	0	0	
18	Ariyankuppam (Check Zone)	1.1	1.3	2.0	2.0	0	1.3	0	

TABLE 33

s from the eighteen fixed catching stations in Pondicherry

	May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
.3	33.3	33.3	0	16.7	21.6	10.0	19.2	10.3	9.0	16.0	11.0	10.0	15.3	22.0	9.9	9.2
.0	12.1	14.0	16.3	14.0	11.0	15.0	16.0	18.0	19.0	7.0	11.0	10.0	11.2	13.0	18.0	17.0
.3	0	0	0	0	0	8.0	6.0	13.2	12.5	16.0	10.3	16.0	11.0	12.8	7.0	19.0
.0	16.7	53.0	9.0	11.1	22.2	25.0	21.4	23.7	15.4	19.3	19.4	19.0	17.0	11.1	20.8	22.0
0	20.0	0	0	0	0	5.0	12.7	13.6	9.3	28.3	6.0	13.3	18.7	11.8	5.9	16.1
.7	16.3	21.0	0	0	0	0	8.3	4.9	16.7	13.3	4.9	22.2	10.0	15.4	5.6	17.6
.0	25.0	14.0	0	0	8.7	4.3	14.0	16.7	16.3	21.0	16.0	25.0	12.9	16.7	24.7	22.8
.0	29.4	15.0	0	25.0	0	7.9	9.0	16.9	10.4	12.0	18.6	4.3	15.2	6.3	4.0	7.1
.9	17.4	15.0	0	0	15.0	11.2	10.9	13.0	17.5	10.8	12.0	5.0	6.0	6.0	8.0	23.0
0	0	25.0	0	0	0	15.4	9.0	27.3	26.7	27.3	13.6	13.0	13.6	11.1	19.0	20.4
.1	22.2	16.6	16.7	13.3	15.8	14.1	11.0	18.0	13.0	17.6	33.3	9.5	10.7	15.0	12.0	11.5
0	0	5.6	0	10.0	12.5	10.3	8.3	0	8.3	8.8	4.3	8.3	0	5.3	4.3	5.9
.3	8.9	6.0	11.0	0	0	9.0	5.9	18.2	5.6	19.0	10.0	0	15.5	10.5	11.5	19.0
.6	0	3.2	0	0	14.3	17.0	9.8	23.2	9.2	13.5	5.0	19.1	18.0	17.3	0	15.9
.7	10.3	12.0	0	10.0	5.6	10.0	15.2	17.0	13.0	8.0	11.0	13.3	11.0	17.8	19.0	10.6
0	0	23.0	10.0	0	17.4	4.8	4.0	16.7	0	22.2	5.0	0	4.1	11.1	8.7	2.7
.4	7.7	8.5	20.0	0	0	7.0	9.0	23.5	11.1	17.4	7.1	40.0	0	8.3	0	12.2
0	5.0	7.9	5.9	6.6	7.3	10.6	8.3	7.3	16.2	6.5	13.2	11.3	13.8	20.1	11.8	14.0

TABLE 34

inquefasciatus from the eighteen fixed catching stations in Pondicherry

	May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.	
:I	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
0	16.3	0	0	0	0	0	1.9	1.0	2.0	1.0	2.0	2.0	1.2	2.9	0	1.3
.0	0	1.1	0	0	0	0	1.0	1.0	1.0	0	0	0	1.0	0	0	2.0
0	0	0	0	0	0	0	0	1.5	0	2.0	1.0	0	0	3.2	0	1.0
0	0	6.7	0	0	0	0	0	1.7	0	0	0	0	1.0	1.0	1.0	0
0	0	0	0	0	0	0	2.5	0	0	3.8	0	0	0	0	0	0
0	0	0	0	0	0	0	4.2	3.3	4.2	2.2	0	3.7	0	0	0	0
0	0	0	0	0	0	0	1.0	2.0	1.3	1.0	0	3.6	1.1	0	0	0
0	0	0	0	0	0	0	1.0	1.5	0	0	4.7	0	1.3	0	0	0
0	0	3.7	0	0	0	1.1	0	2.0	0	0	1.0	0	0	2.0	0	0
0	0	0	0	0	0	0	0	9.0	0	9.0	0	0	0	0	0	0
0	0	0	0	0	5.3	0	0	1.0	0	1.9	22.2	4.8	0	0	4.0	0
0	0	0	0	0	4.2	0	0	0	0	0	4.3	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	9.5	0	0	0	2.6	0	0
0	0	0	0	0	0	0	0	1.0	0	1.9	0	0	0	3.8	0	0
0	0	0	0	0	0	1.4	2.5	1.0	0	0	0	1.0	0	2.5	1.0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	3.8	0	0	0	0	0	1.0	2.9	2.8	4.3	0	0	0	0	0	1.2
0	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.9	2.9	5.3	0.9	0

TABLE 35.

Biting density (No. of females collected/man/hour) of human biting population (7-00 p. m. - 10-00 p. m.) of *Culex quinquefasciatus* from six selected catching stations

S. No.	Catching stations	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC.
1.	S. E. Bouleward (Control Zone 1)	9.7	14.2	8.2	13.8	14.5	6.3	10.9	9.9	5.1	10.7	1.0	5.8
2.	Muthialpet (Control Zone 2)	14.2	4.9	1.1	3.3	8.9	5.9	13.4	9.3	12.3	35.3	3.7	1.7
3.	Karuvadikuppam (Control Zone 3)	2.0	2.9	0.7	0.9	0.2	0.2	3.9	3.5	1.3	0.6	0	0
4.	Kosapalayam (Control Zone 4)	1.9	2.3	0.9	0.7	0.3	0.1	1.7	4.3	3.0	4.9	2.7	2 6
5.	Mudaliarpet (Control Zone 5)	1.9	1.2	0.2	0.7	0.6	0.2	2.5	1.5	1.4	2.5	0.7	1.7
6.	Ariankuppam* (Check Zone 7)	5.3	4.4	0.9	0	0.5	0	0.5	8.8	4.4	15.2	2.0	5.2

*From August onwards Check Zone is Cuddalore.

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TABLE 36.

Parous rate of human biting population of (7-00 p.m. 10-00 p.m.) *Culex quinquefasciatus* from six selected catching stations

S. No.	Catching stations	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.	S. E. Bouleward (Control Zone 1)	57.7	44.1	42.9	50.9	16.7	50.0	50.3	27.7	52.5	41.9	33.3	51.7
2.	Muthialpet (Control Zone 2)	43.9	44.8	38.5	32.5	26.8	19.7	69.9	44.1	41.2	42.8	72.7	43.2
3.	Karuvadikuppam (Control Zone 3)	58.6	48.6	75.0	40.0	66.7	100.0	45.8	50.0	42.9	66.7	—	—
4.	Kosapalayam (Control Zone 4)	70.5	64.0	72.7	62.5	50.0	0	64.0	58.8	52.8	64.4	62.5	61.5
5.	Mudaliarpet (Control Zone 5)	47.1	41.7	66.6	75.0	88.8	100.0	55.3	55.6	35.3	41.1	50.0	81.0
6.	Ariyankuppam (Check Zone 7)	44.4	51.9	20.0	—	50.0	—	42.9	48.1	58.5	12.3	83.3	66.2

TABLE 37.

Infection rate of human biting population of *Culex quinquefasciatus* from six selected catching stations

S. No.	Catching stations	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.	S. E. Bouleward (Control Zone 1)	13.9	5.1	7.4	6.2	11.8	5.2	3.7	1.1	3.8	7.4	0	13.6
2.	Muthialpet (Control Zone 2)	7.1	3.6	0	5.2	2.5	7.4	4.5	3.8	7.0	5.6	0	0
3.	Karuvadikuppam (Control Zone 3)	14.0	0	0	0	0	0	2.4	2.1	6.3	30.0	0	0
4.	Kosapalayam (Control Zone 4)	7.5	11.1	6.3	6.3	0	0	1.0	7.1	4.0	17.2	12.5	14.8
5.	Mudaliarpet (Control Zone 5)	4.8	4.2	0	6.3	0	12.5	17.7	43.2	13.3	10.0	0	5.0
6.	Ariyankuppam (Check Zone 7)	3.2	13.4	12.5	0	0	0	0	9.6	7.8	4.5	16.7	24.3

TABLE 38.

Infectivity rate of human biting population of *Culex quinquefasciatus* from six selected catching stations

S. No.	Catching stations	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.	S. E. Bouleward (Control Zone 1)	0.6	0	0	0	8.7	0	0	0	1.0	0	0	0
2.	Muthialpet (Control Zone 2)	0.4	0	0	0	0	0	1.3	0	0	0	0	0
3.	Karuvadikuppam (Control Zone 3)	4.0	0	0	0	0	0	0	1.1	0	0	0	0
4.	Kosapalayam (Control Zone 4)	0	0	0	0	0	0	0	0	1.9	3.3	0	8.3
5.	Mudaliarpet (Control Zone 5)	0	0	0	0	0	0	0	31.2	8.3	0	0	3.3
6.	Ariyankuppam (Check Zone 7)	0	1.0	0	0	0	0	0	2.0	2.3	0	0	9.8

TABLE 39.

Monthly incidence of "Risk of infection" index De Meillon *et al* for 3 hrs. (19-00 hrs – 22-00 hrs) biting catches of *Culex quinquefasciatus* from six fixed catching stations

S. No.	Biting catching stations	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1.	S. E. Bouleward (Control Zone 1)	0.07	0	0	0	0	0	0	0	0.08	0	0	0
2.	Muthialpet (Control Zone 2)	0 07	0	0	0	0	0	0.14	0	0	0	0	0
3.	Karuvadikuppam (Control Zone 3)	0.06	0	0	0	0	0	0	0.04	0	0	0	0
4.	Kosapalayam (Control Zone 4)	0	0	0	0	0	0	0	0	0.08	0.06	0	.19
5.	Mudaliarpet (Control Zone 5)	0	0	0	0	0	0	0	0.16	0.08	0	0	.06
6.	Ariankuppam (Check Zone)	0	0.08	0	0	0	0	0	0.11	0.08	0	0	.29

TABLE 40.

Comparison of the "Risk of infection index" De Meillon *et al* in a biting population of *C. quinquefasciatus* before and after a sustained larvicidal control programme in Pondicherry

Month	No. dissected	Nulli-parous	Age composition				Proportion parous (a)	Biting density per man hour (b)	Proportion infective (c)	Risk of infection index* axbxc	Risk of infection index**
			1-para	2-para	3-para	4-para					
January	33	17	4	9	1	2	0.48	2.75	0	0	0.08
February	56	34	10	9	3	0	0.39	2.37	0	0	0.04
March	18	10	4	1	3	0	0.44	0.75	0.12	0	0.07
April	13	7	3	2	1	0	0.46	0.58	0	0	0
May	29	10	9	8	1	1	0.65	1.20	0.52	0.41	0
June	8	2	5	1	0	0	0.75	0.33	0	0	0
July	122	69	41	12	0	0	0.43	5.08	0	0	0
August	81	44	18	18	1	0	0.45	3.37	0.05	0.08*	0
September	54	34	11	5	4	0	0.37	2.25	0.05	0.04	0.08
October	45	21	11	10	2	1	0.53	1.87	0.08	0.08	0.13
November	17	5	5	7	0	0	0.70	1.42	0	0	0.04
December	34	8	15	6	4	1	0.76	1.42	0	0	0.07

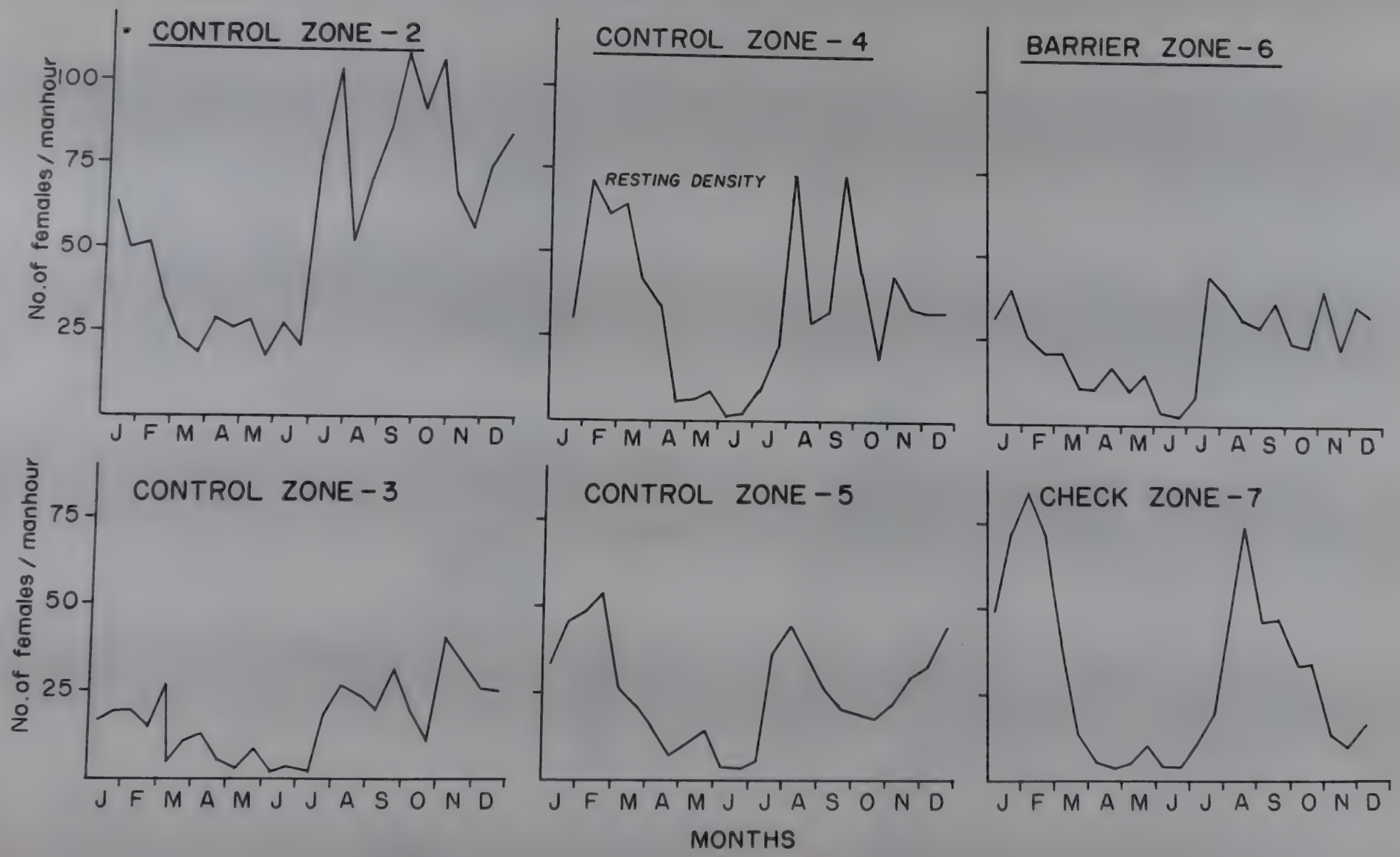
*After starting a larvicidal control programme (1981) (larvicidal operations were interrupted during the months of July-August)

**Before starting a larvicidal control programme (1979-1980)

Fig. 29

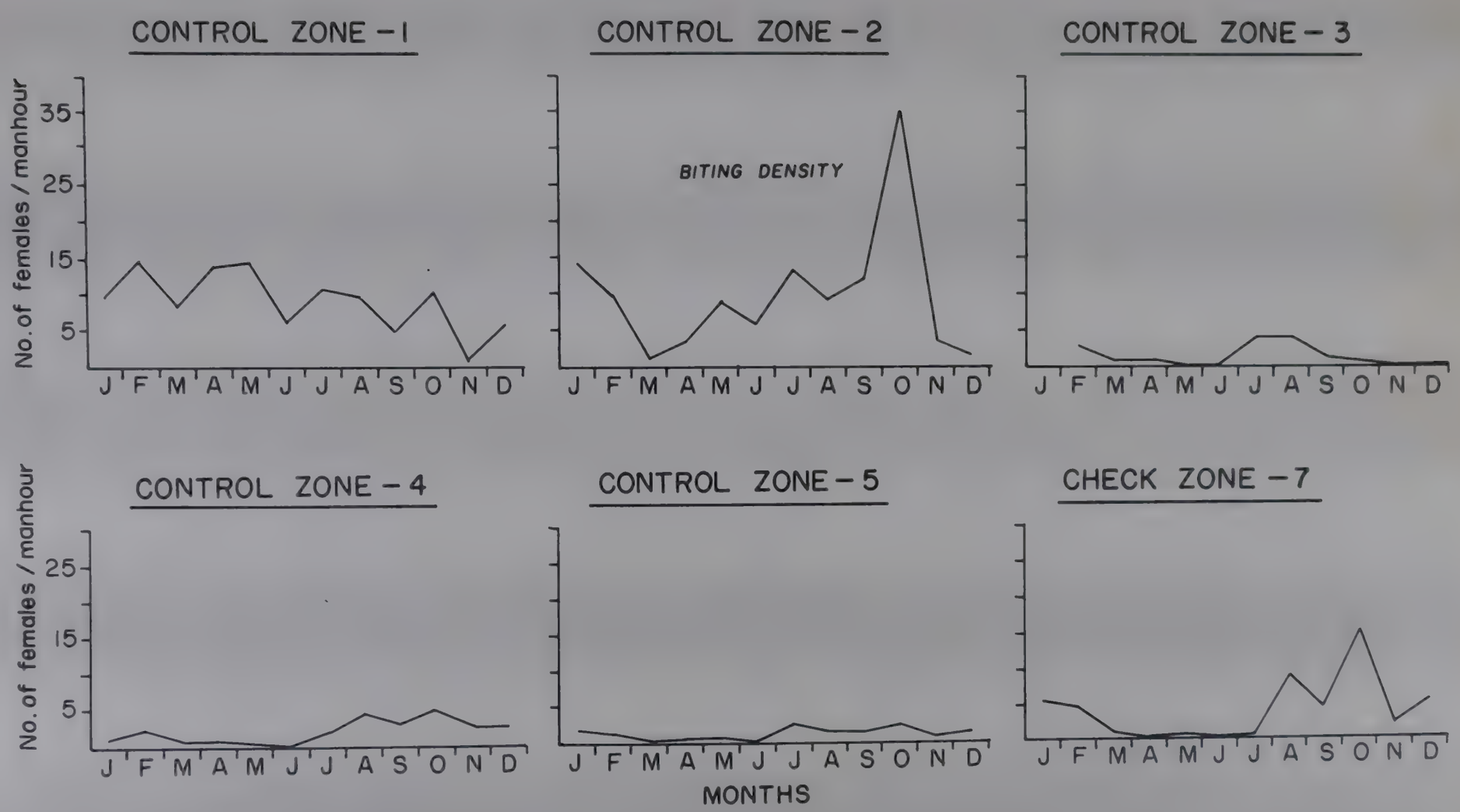
Dissection and examination of adult mosquitoes

Fig. 30



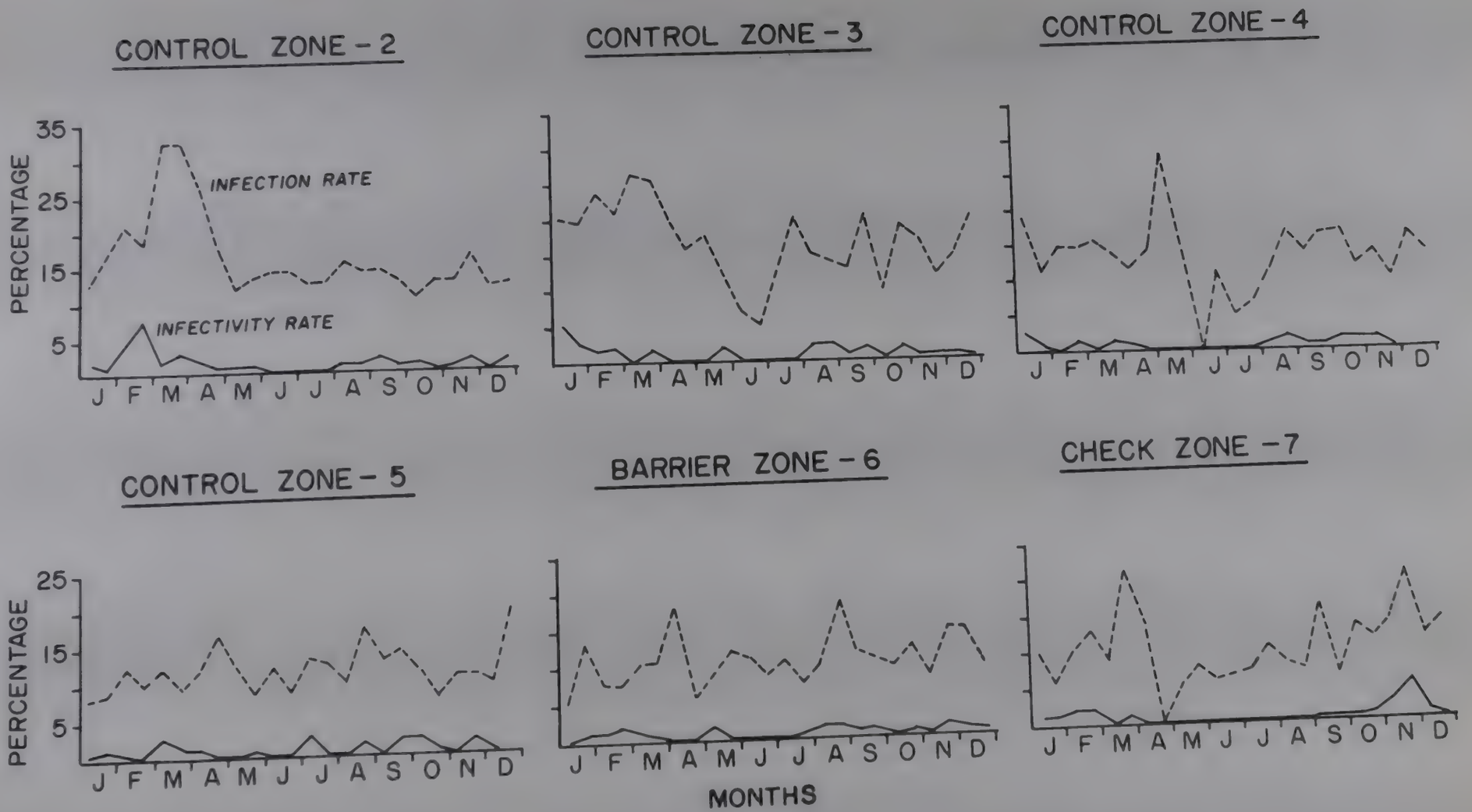
Resting density of *culex quinquefasciatus* in different zones during 1981

Fig. 31



Biting density of *culex quinquefasciatus* in different zones

Fig. 32



Infection and infectivity rate of *culex quinquefasciatus* collected from different zones

TABLE 41.

Number and species of mosquitoes collected in all night human biting collections in Mudaliarpet, Pondicherry.

Month	*Culex quinque-fasciatus*	*Culex vishnui* gr.	*Culex sitiens*	*Culex (L) fascanus*	*Culex bitaenio-rhynchus*	*Aedes aegypti*	*Aedes vittatus*	*Aedes albo pictus*	*Ar. subal batus*	*Ano. subpictus*	*Mansonia annulifera*	Total
January*	33	0	0	0	0	0	0	0	42	0	0	75
February	57	7	1	0	0	0	0	0	81	0	0	146
March	18	14	45	0	0	3	0	0	102	4	0	186
April	14	1	37	0	0	0	0	0	89	0	0	141
May	29	0	3	0	0	0	1	0	42	0	0	75
June	8	1	4	0	0	0	0	0	4	0	0	17
July	122	9	4	0	0	2	1	0	12	1	0	151
August	81	1	0	0	0	28	0	1	16	0	1	128
September	54	17	0	0	2	22	0	0	12	0	0	107
October	45	13	0	1	0	2	0	0	2	1	0	64
November*	17	0	0	0	1	2	0	0	0	8	1	29
December	35	2	0	0	0	1	0	0	39	0	0	77

* In January & November only one fortnight collection was made.

9. SUMMARY OF ACHIEVEMENTS AND BOTTLENECKS DURING THE FIRST YEAR OF PROJECT WORK

The Project aims, that after the stipulated period of five years, the community must take up the work and maintain the gains. Community in this context involves the people and different developmental agencies. To achieve this various actions were taken and the results were discussed in earlier chapters. Though the progress made in achieving official/community participation is far from satisfactory, yet some changes in the attitude was noticed which are summarized below.

An awareness has now been created in the minds of the officials that filariasis or other vector borne diseases cannot be viewed in isolation and Health Department alone cannot solve the problem. Filariasis is an environmental related disease and all the developmental agencies should work in a co-ordinated manner to prevent formation of mosquitogenic condition.

Though cooperation from other departments like PWD, which is responsible for construction and minor engineering works is slow in coming, certain permanent developments are taking place, which will prove to be beneficial to the whole community in the long run. Because of our constant efforts the officials have started realizing that permanent improvements, though it may be costly initially, will prove to be much cheaper in the long run. Hence many developmental activities have now been started, eventhough at a snails pace, and some improvement will be there in due course.

The authorities responsible for environmental sanitation were made to understand that, proper maintenance of drains is a must to contain the mosquito breeding. Initially the practice followed is to take garbage to far off places from the collected area and dump them in a corner. Now, they are also educated on how the garbage and waste soil could be effectively used to fill up nearby low-lying areas, which has also reduced manpower and transportation costs. Numerous low-lying areas are thus getting filled up which is a permanent way of source reduction.

The authorities responsible for development of new colonies, like the Pondicherry Co-op. Housing Society, Housing Board, Town and Country Planning Department were also educated about the mosquitogenic conditions that has been created by the unplanned development of new colonies where no drains exist. Because of this constant education and pressure from the VCRC, the new colonies now being developed are expected to be provided with proper sanitary facilities. The hazards created by low-lying vacant plots are explained to the authorities and all the vacant plots existing in different colonies were mapped and information passed on to the concerned Municipalities to issue notices to the owners, either to fill them up or with the threat to acquire them for development purposes. With lot of difficulty this has gained momentum and it has resulted in lot of filling work being done in the low-lying vacant plots.

A recent outbreak of encephalitis in neighbouring district also helped in its own way. Because of various Health Education Programme launched by the VCRC to achieve community participation, an awareness has now been created that mosquitoes are the root cause for many diseases and also how best it could be prevented by themselves. As a result VCRC is flooded with new information on mosquitogenic conditions in different places. They provide information about the owners of vacant plots. This itself is a good sign of awareness.

Apart from the mosquito control programme, whenever the VCRC officials visit different areas of operation, petty complaints like leakage in public taps, provision of street lights, lack of water in the public latrines, provision of drainage facilities, etc. were lodged by the people of that area, which are readily taken up on their behalf by the VCRC without any reluctance and the concerned authorities were asked to

speed up the matters. This kind of approach by the VCRC staff has created a lot of good will among the people in this study area and they appreciate that somebody atlast is concerned about their colony development. This has also resulted in people giving complaints to the VCRC on matters not connected with their activities.

VCRC is pumping out water free of cost from any plot whose owners undertake to fill the plots immediately after pumping. There seems to be lot of encouragement from the people for this kind of service and it has also created an awareness that VCRC is doing some permanent improvements for the people of Pondicherry.

Regular and disciplined way of spraying and cleaning and door to door approach by the staff of the VCRC, during the past one year has created good impression in the minds of the people that VCRC is doing the job of spraying and cleaning perfectly. During the month of July 1981, the mazdoors of the FCP went on strike and project work was suspended for one month. Many people felt the absence of this project and many demanded that the project should restart as early as possible and certain community leaders were even ready to undertake the job of labour management in that locality. This gave us the strength to restart the project with more strictness and discipline.

Larval evaluation has been strengthened to the possible extent and this has resulted in complete survey of all breeding habitats within a week's time just one day prior to spraying day. This helps in the identification of breeding habitats which are missed or need immediate attention.

In this programme, an integrated approach is being made to drastically control breeding of mosquitoes. All methods like source reduction, sanitation, biological control by release of fishes, and insecticidal control wherever necessary are being enforced. The appropriate choice of method for each habitat is decided according to feasibility and effectiveness of the method.

Because of this planned and need based integrated approach, the man vector contact has been brought down to a very low level when compared to the previous year's level. The data are presented in Table 42. The working cost of this project has been reduced to a considerable extent possible because of the integrated approach to the problem and the cost benefit analysis comparing the different methods are presented in Table 43.

In spite of the best efforts to control larval breeding in the study area, the adult density of the vector remains high in certain pockets like Subbaiah Nagar, Vambakeerapalayam, V.O.C. Nagar, Kurichikuppam, etc. The probable reasons and the failure in containing the mosquito population are due to certain bottlenecks listed below and if removed will go a long way in the success of the project.

a) Subbaiah Nagar

This area is just adjacent to the JIPMER campus. Even though all the habitats in Subbaiah Nagar are kept free from breeding, the adult population persists. In the JIPMER Campus, there are about 500 staff quarters and each one has a covered meter box which is about one metre deep and 50 cm. square. Because of leaks in the water pipe line water stagnates inside the meter box which breeds mosquitoes. Almost all the meter boxes are locked and there is no provision to open them for cleaning or spraying.

Apart from this there are also pucka drains out side every ward which are found to be choked with debris. Eventhough there are about 20 sanitary staff attached to JIPMER for cleaning nobody seems to be doing their allotted work. Hence, during weekly inspection, almost 50-75 per cent of the meter boxes and drains are found heavily breeding and supplying mosquitoes not only to the campus but also to the neighbouring area like Subbaiah Nagar, Jeevanandapuram etc. In spite of repeated requests, no action seems to have been taken by the JIPMER sanitary staff.

b) Vambakeerapalayam

This is an area in which the major drainage/ storm water canals join together and are supposed to drain into sea. As the gradient doesn't permit their flow, all the water accumulates in the canal itself and form a lagoon. Insecticidal spraying is not practicable in such a large volume of water which is also used by many cattle, pigs etc. for drinking. It was therefore suggested to the PWD to construct a pumpshed in the tail end with sedimentation tanks and pump the water into the sea in March 1981 and the then chief secretary sanctioned the necesary expenditure from the Government. But so far no action was taken.

As a permanent measure it was suggested to dig a canal along the natural gradient and connect the same near Veerampattinam area which is 2. 6 kms off from the planned exit. This has also not been done so far. What measures that could be taken up by the VCRC was undertaken but this is a major work which can be taken up only by the Government and unless this work is completed there will be no abatement in mosquito nuisance considering the long flight range of the vector species.

c) V. O. C. Nagar & Muthialpet

These two localities are under the regular activities of the state NFCP. The efficiency of operation, therefore, conforms to the all India pattern as determined by the national programme at Delhi. The method of operations has therefore to be viewed in the all India context, with so many difficulties inherent in the system. Actually zones 1 and 2 will give data on the relative working efficiency of the national programme, where there is very little scope for any change, and a time bound, result oriented, operationally efficient project like the FCDP.

TABLE 42.

Comparison of man vector contact (No. of *Culex quinquefasciatus* per man hour) in 1980 and 1981

Month	Before control 1980	After control 1981	Percentage increase (+) or decrease(−)
January	4.8	2.8	−41.67
February	4.5	2.4	−46.67
March	7.0	0.8	−88.57
April	4.0	0.6	−85.00
May	5.0	1.2	−76.00
June	2.7	0.3	−88.88
July	2.8	5.1	+45.09
August	5.6	3.4	−39.28
September	7.2	2.3	−67.86
October	9.9	1.9	−80.81
November	4.8	1.4	−70.83
December	9.9	1.4	−85.85

TABLE 43.

Cost - benefit analysis

Breeding habitat	Surface area in m^2	Expected expenditure for 100% coverage with (Insecticide alone) Qty. in litres	Cost Rs.	(M.L. Oil alone) Qty. in litres	Cost Rs.	Expenditure incurred during 1981 under various operations (Insecticide alone) Qty. in litres	Cost. Rs.	Cost. of manpower alone	(Environmental) Cost. of manpower alone
Cess pits	1463.14	28.17	3381.36	1902.08	3804.16	28.17	3381.36	—	
Cess pools	184793.63	3558.98	427077.60	240231.68	480463.36	—	—	1920.00	
Kutcha drains	3029.00	58.33	7000.32	3937.70	7875.40	58.33	7000.32	—	
L-Drains	23012.45	443.20	53184.24	29916.17	59832.34	443.20	53184.24	—	
U-Drains	5035.62	96.98	11637.84	6546.28	13092.56	96.98	11637.84	—	
Storm water canals	176112.57	3391.79	407014.80	228946.33	457892.66	188.03 (selected drains only)	22563.84	— —	
Wells	2112.96	40.69	4882.80	2746.84	5493.69	—	—	3840.00	
Total	395559.37	7618.16	914178.96	514227.08	1028454.40	814.72	97767.28	—	
Cost of man power	—	—	149760.00	—	149760.00	—	84480.00	8640.00	78720.00 + 40000.00*
							1,82,247.28	14,400.00	1,18,720.00
Grand Total			10,63,939.00		11,78,214.40			3, 15, 367 . 28	

* Cost of implements

10. SPECIAL FEATURES OF F.C.D.P.

Skeptics at both national and state levels may ask why a special project is necessary for controlling mosquitoes. There are many reasons why the existing National Filaria Control Project cannot achieve targets. To list only a few, there are financial constraints, difficulty in maintaining discipline which is crucial to a work of this kind, lack of operational orientation and inability to change the strategy unless approved at the national level, inspite of knowledgeable and dedicated planners and heads of departments. An attempt is made in the following table to enlist the basic differences in the approach to the problem by the NFCP and the FCDP.

	NFCP	*FCDP*
	Temporary and curative	*Permanent and preventive*
1. Nature	Present method of oiling in breeding places is a continuous phenomenon and never ending process. More and more breeding places will be created and more and more oil will be required.	Present method relies more on permanent inprovement by preventing formation of breeding places and insecticidal use is for temporary relief and its consumption will be reduced to most minimum in due course of time.
	Unidepartmental	*Multidepartmental*
2. Responsibility	National Filariasis Control Programme is responsible for the control of filariasis, by oiling breeding places and by treating the mf carriers in day and night clinics.	Since the programme is preventive in nature, to find out a permanent solution the activities of different departments involved in developmental activities like PWD, Town planning. Municipalities, Health Department etc. are co-ordinated.
3. Source modification	Though in FCP manual scrapping of drains is recommended it is rarely done. Therefore source modification plays a limited role.	In the present programme source modification plays an important role and all breeding habitats are being maintained free from breeding by regular cleaning and scrapping.
4. Source reduction	Never tried	Given top priority
5. Duration	Unlimited	Time bound (five years)

6. Flexibility in approach	Rigid pattern	Very much flexible
7. Area of operation	11.34 km² which is limited only to district boundaries.	48.04 km² geographically continuous area
8. Insecticide used	ML oil alone (90,825 litres / year)	Fenthion and Phenthoate (800 litres / year)
9. Cost of insecticide alone / year	Rs. 1,61,651	Rs. 96,000 only
10. Field workers employed	90	80
11. Population covered	1,08,290	1,58,429
12. Staff discipline	Being permanent employees, discipline is difficult to enforce	Employed on hire and fire basis and a strict discipline is being maintained
13. Evaluation	No feed back of results of evaluation to operational teams	Regular evaluation for improving the control programme, as well as to get an idea of the impact of the control measure
14. Equipment maintenance and supply procedures	Complicated and leads to unnecessary delays	Simple and immediate

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Tmt. Renuka Appadurai Hon'ble Health Minister, Govt. of Pondicherry, has taken keen interest since the inauguration of the project, and taken pains to personally inspect the problem areas along with Thiru Perumalraja, the PWD Minister and the officials concerned and ordered necessary remedial measures on the spot, without which the progress achieved so far will not be to such an extent.

Thiru P. V. Jaikrishnan, former Chief Secretary, and to Thiru R. Badrinath, present Chief Secretary, Govt. of Pondicherry, who have taken keen interest in the implementation of the various improvements suggested and whenever they were approached for financial or technical sanction, they have come with a ready helping hand.,

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Mr. R. Lakshmikanthan, former Commissioner, Pondicherry Municipality and presently the Additional District Magistrate, Govt. of Pondicherry, Mr. J. Deivasigamani, Director, PWD and Mr. Raman, Executive Engineer, PWD, Mr. K. Martin, Senior Town Planner, present Commissioners of Pondicherry and Ozhukarai Communes and to Dr. Keerthiseelan, Municipal Health Officer, Pondicherry Municipality, all of whom have given attention to the needs of the project, and taken steps to implement the various suggestions given by various committees to see this study area free of mosquitogenic conditions.

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Great is Sanitation, the greatest work, except discovery, I think, that a man can do.... What is the use of preaching high moralities, philosophies, policies and arts to people who dwell in.... appalling slums...? You must wipe away those slums, that filth, these diseases.... We shall reach the higher civilization, not by any of the politicians' shibboleths, methods of government, manners of voting, liberty, self-determination, and the rest, all of which have failed - but first by the scientific ordering of cities until they are fit for men of the higher civilization to dwell in. We must begin by being Cleansers.

— Sir Ronald Ross

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